Knowledge Intensive Business Services (KIBS) and regional development : some implications for de-industrialised regions

KNOWLEDGE INTENSIVE BUSINESS SERVICES (KIBS) AND REGIONAL DEVELOPMENT: SOME IMPLICATIONS FOR DE-INDUSTRIALISED REGIONS

A Thesis

by

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DECLARATION OF AUTHORSHIP

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declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.

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I confirm that:

1. This work was done wholly while in candidature for a research degree at this University;
2. Where I have consulted the published work of others, this is always clearly attributed;
3. I have acknowledged all main sources of help;

Signed:

Maja Savic

Date: 25th July 2016

ABSTRACT

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Maja Savic

In a modern, learning economy the primary task of industrial and innovation policies should be to promote innovative interactions between economic sub-systems, organisations and individuals. KIBS are particularly important in these processes, not only because of the significance of their own growth and innovativeness, but also because of their systemic role in influencing the innovation activities of client firms. A number of studies also show that the expertise provided by KIBS is associated with economic growth and can therefore be treated as a factor of production alongside capital and labour. Since most previous research has focused on globalised KIBS located in metropolitan regions, there has been a dearth of studies of KIBS SMEs located in de-industrialised regions. This thesis examines their *structural role* (in terms of tradability and support to customers) and their *systemic role* (as innovators and facilitators of knowledge and expertise across space).

One of the main contributions of this research is that it improves understanding of the role KIBS play in regional economic development. The results of the survey are the key novelty as well as theoretical contribution which relates the literature on knowledge bases to KIBS. Findings indicate that in de-industrialised regions local markets constitute a more important source of demand compared to metropolitan regions such as London. In addition, the results indicate that characteristics of intermediate demand vary across different KIBS sub-sectors, with engineering KIBS being relatively more reliant on the manufacturing base. For them, further de-industrialisation may pose survival challenges and regional policies therefore need to support them through technological upgrading based on old industrial formations. The majority of KIBS depend largely on other services, hence there would seem to be a scope for devising separate, service oriented policies. For those KIBS that largely depend on government contracts and consumer demand, however, prospects remain uncertain and bleak. This research shows that KIBS innovation is supported by engagement in various external knowledge networking within and outside their respective regions but the results indicate that in order to reap the benefits form external knowledge, firms' capacity must be built. Also, KIBS sub-sectors vary with respect to their role as knowledge agents as some are associated with the analytic knowledge base (Engineering and Architecture and R&D and Technical) and some with the symbolic knowledge base (Computer and related and Management consultants).The issue of transferability of knowledge is particularly important for KIBS as they act as knowledge facilitators and findings suggest that some types of knowledge (e.g. analytical) are indeed easier to transfer across space.

KEY WORDS: KIBS, de-industrialised regions, regional development, innovation, external knowledge, knowledge bases

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LIST OF ABBREVIATIONS

ABI	Annual Business Inquiry
BRES	Business Register and Employment Survey
CATI	Computer Aided Telephone Interview
CIS	Community Innovation Survey
GDP	Gross Domestic Product
GOR	Government Office Region
GVA	Gross Value Added
HMRC	Her Majesty's Revenues and Customs
IDBR	Interdepartmental Business Register
KIBS	Knowledge Intensive Business Services
LA	Local Authority
LQ	Location quotient
NACE	Nomenclature Generale des Activites Economiques dans l'Union Europeenne
NAICS	North American Industry Classification
NELEP	North East Local Enterprise Partnership
ODPM	Office of the Deputy Prime Minister
OECD	Organisation for Economic Cooperation and Development
ONS	Office for National Statistics
PAYE	Pay as you go
R&D	Research and Development
SIC	Standard Industrial Classification
SOC	Standard Occupational Classification
VAT	Value Added Tax

CHAPTER 1: KIBS (PRODUCER SERVICES): SETTING THE SCENE

1.1 Introduction to this Research

This thesis is about the role of KIBS[1] in economic development in de-industrialised regions. It proposes a new conceptual framework for understanding the role of KIBS SMEs in regional development which is tested with the unique dataset created through an original survey of KIBS SMEs in the West Midlands and the North East. So far in the literature there has been no systematic attempt to develop a framework which would aid our understanding of the role of KIBS in different regional settings. The proposed framework is based on three dimensions.

First, KIBS SMEs play an important structural role in regional economies. This structural role comprises of two elements: first KIBS are important contributors to the regional economic base since they generate extra regional exports; second, they serve as facilitators and knowledge generators aiding exports and innovation in their customers. Hence, KIBS role is structural and dependent on the role of intermediate demand[2]. In turn, the nature of intermediate demand determines regional specialisation in KIBS. Second dimension relates to KIBS as innovators in their own right and one of the key tasks is to establish determinants of KIBS own innovativeness. Third dimension relates to KIBS sub-sectors which differ in their role as knowledge facilitators as they are characterised by different knowledge bases. The second and third dimensions relate to KIBS' systemic role as they are perceived as innovators and facilitators of

[1] Most KIBS markets are dominated by national and international KIBS which offer and often combine expertise in management consulting, accountancy, finance, marketing and advertising, digital, ICT and software and technical and engineering applications. In the UK, their national head offices are usually located in London and the South East. Their presence in other regions is that of corporate branch offices and an array of KIBS SMEs.

[2] The final demand consists of personal consumption, investment, exports and government purchases, whereas the intermediate demand consists of demand from manufacturing and other services.

knowledge across space. Hence, this research recognises that different KIBS sub-sectors may play different roles in promoting knowledge generation and facilitation.

This conceptual framework is matched with new empirical evidence from the two de-industrialised case study regions in the UK, the North East and the West Midlands. The analysis is based upon an original survey of KIBS SMEs conducted in the two regions, in August 2010. The results reveal the importance of the specific role which KIBS SMEs play in de-industrialised regions which is largely determined by the nature of regional industrial specialisation, local innovative milieu, regional and extra regional networks and differentiated knowledge bases.

This research started from the observation that, one the one hand, geographers and regional scientists have largely focused on the role of urban economies in the concentration of KIBS and/or existence of centrifugal or centripetal forces shaping the distribution of KIBS closer to or away from the large urban areas. The empirical stylised facts emerging from this literature show that KIBS are concentrated in large urban areas and that despite the ICT revolution, location patterns are highly stable over time. However, this stream of literature rarely takes into account the role of intermediate demand or innovation considerations in examining the location of KIBS.

On the other hand, research on innovation which recognises the role of KIBS as producers and diffusers of knowledge, has also investigated their interaction with local factors and contribution to regional development. This literature, however, largely neglects spatial patterns of KIBS activities. More recently the first steps towards analysing spatial patterns of KIBS and innovation have been undertaken (see for example Shearmur and Doloreux, 2009; Doloreux and Shearmur, 2012; Meliciani and Savona, 2014). In line with this literature, it is acknowledged in this thesis that the sectoral composition of regional economies and the nature of intermediate demand and inter-sectoral linkages are important determinants of regional specialisation in KIBS (Meliciani and Savona, 2014).

The conceptual contribution of this thesis is not only to join the above two theoretical perspectives but to assess KIBS role by establishing the significance of both sectoral and spatial proximity on KIBS demand; KIBS exporting potential; the role of networks in KIBS innovativeness; and from the sectoral systems of innovation perspective to determine which underlying knowledge bases define different KIBS sub-groups. This research thus, proposes a new conceptual framework for analysing the role of KIBS. For this reason this thesis draws from a wide literature on industrial location, export base, systems of innovation, networks, innovation in services and differentiated knowledge bases.

1.2 Background

> *"Services represent the fastest growing sector of the global economy and account for two-thirds of global output."* World Trade Organization (2009).

Despite some academic interest services were until recently largely neglected in the literature. Moreover, Howells (2000) notes:

> "*Even those academics and policy makers who have realised that services do have a larger part to play in the economy still tend to view them as providing a supporting, infrastructural role, 'serving' the rest of the economy as facilitators, mediators and repositories in the knowledge-based economy*."

Modern economies are inescapably service economies (Gallouj and Djellal, 2010, 1). Many developed market economies have experienced continued growth of services employment and declining employment in manufacturing. Since the process of de-industrialisation started several decades ago in the US, UK, France and Japan, to name a few countries, services have become the main source of wealth and jobs. However, in the UK, the most recent economic downturn which started in 2008 and which was sparked by the credit crisis has seen the renewed interest by governments in stimulating manufacturing production. Thus, between 2012 and 2013 there has been an increase of employment in both manufacturing and services in the UK (OECD, 2014)[3]. This highlights the complexity of the economic restructuring process as a replacement of manufacturing

[3] According to the OECD data employment in services in the UK increased from 23,511,900 in 2012 to 23,917,420 in 2013 and employment in manufacturing increased from 2,886,775 in 2012 to 2,913,900 in 2013.

employment by employment in services has been happening but the process is not continuous.

The long term process of economic restructuring is particularly relevant for our understanding of the nature of spatial economic imbalances in the UK. The scale of spatial economic imbalances in the UK has been growing since the late 1970s, it accelerated during the 1980s and continued to increase in the 1990s and the first decade of the 2000s (Martin, 1993; Martin et al., 2015). These economic disparities have been constituting the “North-South Divide” (Martin, 1993). In the UK, only three regions namely, London, the South East and the East have performed above the UK average since 1997 and the disparities between the leading and the lagging regions are persistent (Huggins and Izushi, 2008; Huggins and Williams, 2011). Further, the scale of spatial imbalance in the UK has increased faster than in other major European countries and also (at the state level) that of the US (Martin et al., 2015).

One of the most persistent outcomes of the rise of a service economy in the last couple of decades in the UK has been uneven regional development often associated with lagging employment growth in KIBS outside London and the South East (Wood, 2009). In the UK, research on KIBS has emphasised the persistent uneven concentration of KIBS favouring prosperous regions such as London and the South East. In prosperous regions, KIBS benefit from sophisticated regional demand as well as a supply of knowledge networks, good soft and hard infrastructure, excellent transport links and a skilled work force, enabling them to function in international markets (Wood, 2002). As a result, KIBS in such developed regions are successful on a much larger scale than their counterparts in more peripheral locations. These developments may emphasise and reinforce the disadvantages that those KIBS located in de-industrialised regions face. And as KIBS contribute to increased regional disparities the need for policies to ameliorate this trend has been recently emphasised by Wood (2009).

Moreover, as the recent recession had its roots in the London based financial KIBS, the assumption that its impact would be felt more strongly in London and the South might be expected to reduce spatial inequalities in the UK. However, contrary to predictions, the largest increases in unemployment in both services and manufacturing were noted in former manufacturing regions, notably the West Midlands, Wales and parts of the North, with London and the South performing relatively well (Lee, 2014). This, together with a policy response to support the banking sector shows that regions may have very little protection from economic problems which are sparked elsewhere. The next two sections define KIBS and de-industrialised regions respectively.

1.3 Defining KIBS

The term KIBS was first introduced by Miles et al. in 1995[4]. Related terms such as advanced producer services (APS) or business services (which have been in use for much longer) coexists in the field or regional economics and economic geography (see for example Keeble and Nachum, 2002; Wernerheim and Sharpe, 2003). This difference in terms is a result of the development of two distinct scholarly traditions, namely KIBS geography and KIBS innovation studies. Geographers promote the following terms: “advanced producer services”, “high order producer services” or simply “producer services”, whereas KIBS innovation scholars use the term “knowledge intensive business services”-KIBS.

Muller and Doloreux (2009) argue that in the recent past there has been a shift towards the use of term KIBS, which represents more than just a semantic change. This change is due to a shift away from the emphasis on the geography of producer services, towards investigating connections between KIBS and certain labour market, economic and socio-economic indicators (Shearmur and Doloreux, 2008, 3) as well as their own innovativeness.

Toivonen (2004) provides a comprehensive account of KIBS definitions. Toivonen (2004) notes that there are many definitions of KIBS but that there is no standard approach or commonly accepted definition of

[4] Miles et al. 1995 divided KIBS into two broad categories Technology KIBS-T-KIBS and Professional KIBS-P-KIBS. More recently, the third group Research KIBS- R-KIBS, have been introduced (Miles, 2008). In this thesis Technology KIBS comprise: Engineering, Computer and related, R&D, Technical testing and Architecture and Professional KIBS comprise: Management consultants, Market research, Advertisers and Publishers.

KIBS. Many studies adopt Miles et al. (1995) seminal definition of KIBS. In this thesis the Miles et al. (1995) definition is also adopted. Miles et al. (1995, 28) defined KIBS as:

> *"...services that are involved in economic activities which are intended to result in creation, accumulation or dissemination of knowledge. They either supply products which are themselves primarily sources of information and knowledge to their users (e.g. measurements, reports, training, consultancy), or use their knowledge to produce services which are intermediate inputs to their client's own knowledge-generating and information-processing activities (e.g. communication and computer services)".*

One of the main characteristics of KIBS is that their main clients are other businesses and that they rely on knowledge as a source of their competitiveness. Any empirical research on KIBS, however, is faced with the difficulty of identifying only those KIBS that serve exclusively other businesses excluding those also serving individual consumers. This difficulty is particularly pronounced in the UK and Europe. This is because the UK Standard Industrial Classification (SIC)[5] and European's Classification of Economic Activities in operation in EU countries (NACE) are both based on the actual final output (product) rather than the nature of the provision of service in question. It should be noted that the USA and Canadian North American Industry Classification System (NAICS) is based on the production process. This difference in industrial coding structure between continents also adds to the difficulty of providing consistent classification in cross continental comparative studies of KIBS.

Many KIBS, as measured by the SIC/NACE, serve individual consumers and not just other businesses. For example, some of the SIC/NACE financial services include retailers who serve predominantly individual consumers rather than other businesses. Also, many creative sector enterprises (except advertisers) do not exclusively serve other

[5] A Standard Industrial Classification (SIC) was first introduced into the UK in 1948 for use in classifying business establishments and other statistical units by the type of economic activity in which they are engaged. The classification provides a framework for the collection, tabulation, presentation and analysis of data, and its use promotes uniformity. In addition, it can be used for administrative purposes and by non-government bodies as a convenient way of classifying industrial activities into a common structure. Since 1948 the classification has been revised in 1958, 1968, 1980, 1992, 1997, 2003 and 2007.

businesses either. Moreover, many legal, IT and accounting firms, as well as some architects and publishers also serve individual consumers. It follows that the above and perhaps any SIC/NACE based definition of KIBS is somewhat arbitrary.

In this research the core empirical analysis is based on the authors own survey of KIBS SMEs. In order to restrict the survey analysis to those KIBS which predominantly serve other businesses, FIRE sector (Financial, Insurance and Real Estate) as well as legal and accountancy and some creative sub-sectors have been excluded. Another reason for excluding the above mentioned sectors is related to the emphasis of this research on knowledge intensive KIBS. It is acknowledged that many of the excluded KIBS such as legal, accountancy, and financial and insurance firms provide highly routine services.

As Simmie and Strambach (2006) note, the provision of knowledge intensive services consists of KIBS adapting their expertise to the particular needs of their clients. They propose that routine services should be excluded from the definition of KIBS. Table 1.1 provides the selection of KIBS as employed in the original survey conducted in two de-industrialised regions, the North East and the West Midlands. This selection follows the broad consensus which exists in the literature about NACE codes differentiating KIBS. Muller and Doloreux (2007) note that these NACE codes include: NACE 72-computer and related activities, NACE 73-research and development and NACE 74-other business services. This NACE classification is reconciled to the UK SIC classification and comprises of the following SIC codes: 72, 73 and 74, which are used in this study. Next section provides a definition of de-industrialised regions as well as justification for the choice of the two case study regions.

Table 1.1 Classification of KIBS by SIC

SIC categories included in a survey of KIBS in de-industrialised regions:
1. R&D
73 Research and Development
2. Computer and Related Activities
7219 Hardware consultancy
7220 Software consultancy and supply
7230 Data processing
7240 Database activity
3. Knowledge intensive "other business activities", excluding functions such as catering, security, cleaning, packaging, secretarial agencies, legal, accountancy and labour recruitment.
7413 Market research/public opinion polling
7414 Business/management consulting
7415 Management activities, holding companies
7420 Architectural/Engineering
7430 Technical testing and analysis
4. Creative sectors
221 Publishing
744 Advertising

Source: Modified from Wood (2006)

1.4 Defining De-industrialised Regions

This section begins by defining the term "region" it then proceeds to define "de-industrialised regions". So far, researchers have embraced numerous scales and an array of units of analysis on a sub-national level. Within the regional innovation approach, the term "region" has been applied to various territories and jurisdictions, for example the Canadian provinces (Wolfe and Gertler, 1998), former Government Office Regions (GORs) (Johnston and Huggins, 2009), small-scale industrial districts below urban level (Asheim and Isaksen, 2002) as well as NUTSII regions which do not necessarily correspond to any administrative jurisdiction (Evangelista et al., 2002).

In this thesis the "region" is geographically-defined, administratively-supported arrangement that corresponds to former GORs boundaries. This arrangement consists of innovative networks and institutions that interact with innovative outputs of regional firms on a regular basis (Cooke, 2001). This thesis also recognises that regional firms make use of both endogenous and exogenously available knowledge to maintain competitiveness. This definition is justified as former GORs exhibit distinct institutional and historical background. Many former GORs in the UK share industrial past and more recent process of de-industrialisation which can be broadly defined as social and economic change caused by the removal or reduction of industrial capacity, especially heavy industry or manufacturing.

According to Glasmeier and Howland (1993, 223) *"perhaps the largest limitation of existing literature on services and economic development is the lack of specificity in the use of terms such as hinterland, peripheral, provincial, rural and so on".* It is noted that the emphasis in this study is on KIBS role in regional development in de-industrialised regions. Birch et al. (2010, 40) define de-industrialised regions as:

> "*Those regions that were at the vanguard of early industrialisation in the European economy, geared to the exploitation of coal and other raw materials".*

Boschma and Lamboy (1999) note that:

> "*The principal source of their (de-industrialised regions) growth was the specialisation in products which were (1) basic inputs to other sectors (steel, trains and rail infrastructure, chemical products, electronics), or (2) mass consumption goods (textiles, cars). These products had a strong position on the market, but only for a certain - sometimes quite long - period. Their physical and institutional structure had been developed in order to sustain these basic sectors. Educational institutions, railway connections, ports and housing, all had received a strong impact from this dominant production structure."*

This study focuses on the role of KIBS in two de-industrialised regions in the UK, the North East and the West Midlands. Both regions were characterised by heavy industrialisation from the late 18th century onwards and a sharp decline in manufacturing sector from the mid-20th century onwards. The 18th century saw the emergence of the Industrial Revolution, which in the North East gave rise to steel and metal processing industries and shipbuilding. These industries in the North East were developed and located near the coalmines for the ease of access. The invention and use of steam engines in coal mining ensured cheap and reliable supply of coal to the iron and steel production. Steam technology also improved cloth weaving process and gave rise to mass production of cheap and thin cloth and subsequent rise of textile industry which was predominantly based in Greater Manchester and Southern Lancashire (North West). Parts of English West Midlands such as the “Black Country” became one of the most industrialised regions in the 19th century. The “Black Country” was home to coal, iron and steel industry and foundries. These industries supported the West Midlands prosperity in the 1930s and 1940s which lasted until 1960s.

The 20th century saw a decline in coalmining in both regions. In the mid-20th century production largely migrated to cheaper overseas locations (Hudson, 1992). As a result both regions suffered a sharp decline in manufacturing jobs. According to Hudson (1994, 2005), with the rise of Fordism and mass production and subsequent transformation towards post-Fordist high tech manufacturing, coupled by increased international competition, these regions have become marginalised leaving them with many problems of adaptation and lack of competitiveness. The decline in the West Midlands is further exacerbated by recent plant closures in the vehicle manufacturing industry[6]. This was followed by a decline of a number of SMEs who served as component suppliers to the motor industry. In the North East, in particular, this relates to recent job losses in the steel industry.

Hence, the issue of regional economic development in these two regions is of pressing importance. It should be noted that despite some notable differences in the industrial profile of the two chosen case study regions (as presented in Chapter 3) this thesis aims to provide empirical evidence which can be generalised to other regions which experienced de-industrialisation. Thus, the empirical analysis (Chapters 5, 6 and 7) treats the two regions as one entity.

[6] In 2005, MG Rover shut its plant at Longbridge in the Midlands and as a result around 6,300 staff lost their jobs.

Another reason for such treatment is because survey results reveal very little differentiation between the two regions. Appendix I shows properties of variables used in the survey analysis. Simple T-Test results are shown in Table I, Appendix I (additional Chi-Square Test was performed on categorical variables as well as Mann-Whitney on the rest) and only variables highlighted in bold represent statistically significant differences between the two regions. Moreover, when variables' means are compared it can be concluded that these differences are indeed very small. Doloreux et al. (2008), in their study of KIBS in different regions in the province of Quebec (Canada), also found very little differentiation in the characteristics of KIBS according to their location. Similarly to this research, they found that major differences exist between KIBS sub-sectors.

Todtling and Trippl (2004) argue that the issues surrounding renewal of de-industrialised regions have been neglected in the regional studies literature, which is instead focusing on clusters and learning regions. Hence, the important question which this research aims to address is, how far can KIBS serve as engines of economic development in such regions? Different paths towards regional development have been proposed in the literature. The idea of regional development bypassing industrialisation has been emphasised by North (1955).

Douglas North (1955) pointed out:

> "*There is no reason why all regions must industrialise in order to continue to grow. A great deal of secondary (and tertiary) industry will develop automatically either because of locational advantages of materials oriented industry or as passive reflection of growing income in the region resulting from the success of its exportable commodities*".

Following this line of reasoning, initially regions can develop through exporting commodities and subsequently developing secondary and tertiary sector. Moreover, if particular sectors (such as KIBS) are sufficiently "footloose", regional development policies may be devised to promote and attract them to these regions. An alternative view which emphasises the organic linkages between goods and services, claims that losing competitive advantage in the production of goods may affect the demand and the type of services required by the regional economy (Bryson and Daniels, 2015). Closely related to the above analogy is argument about traditional non-tradability of services, given their non-storability (which means that they must be produced and consumed at the same time) and their intangibility (which means that the uncertainty regarding the quality of services often requires close and continuous interaction between service provides and customers) (Miozzo and Soete, 2001). Thus, the question is whether regions can develop their service sector independently of manufacturing demand and to what extent is sectoral and geographic proximity important for KIBS in de-industrialised regions? Next section attempts to establish the link between KIBS and regional economic development.

1.4 KIBS and Regional Development

For some time before they started attracting attention from innovation and management scholars and economists alike, economic geographers took an interest in KIBS/producer services (see for example, Gillespie and Green, 1987; Daniels, 1991; Keeble et al., 1991; Wood, 1991; Marshal and Wood, 1992). Following seminal work by Bessant and Rush (1995) and Miles et al. (1995) they also started attracting interest from innovation scholars (Tether et al., 1012, 3). As noted above, Miles at al. (1995) introduced the neologism “knowledge intensive business services” (KIBS) and since then much has been written about KIBS as drivers of economic growth and innovation. KIBS are interesting not only because they are highly innovative, typically provide highly paid and stimulating work and are growing rapidly but because they are important actors in regional and sectorial systems of innovation. KIBS role is to help clients to innovate and to participate in the production and transmission of knowledge within these systems (see for example Muller and Zenker, 2001; Wood, 2002; Tether and Tajar, 2008; Tether et al., 2012).

Empirical evidence from Canada, USA and Europe shows that KIBS predominantly locate in large metropolitan regions (see for example Marshall and Wood, 1995; Coffey and Shearmur, 1997; Keeble and

Nachum, 2002; Wood, 2002; Daniels and Bryson, 2005; Wood, 2002; Shearmur and Doloreux, 2008). In the UK KIBS are geographically concentrated in London and the South East of England (Keeble et al., 1991; Bryson et al., 1993; Coe and Townsend, 1998; Wood, 2006; Chadwick et al., 2008). As a result research on the geography of KIBS has been largely conducted with reference to prosperous and large metropolitan regions. In the UK context this translates to KIBS located in London and the South East of England.

Increasing number of services and many KIBS contribute to the "economic base" of their regions, meaning that they export their output outside the region and often internationally and bring the revenue to their local area (see for example Daniels, 1983; Beyers, 2002; Illeris and Philippe, 1993; Gallouj, 1996; Massini and Miozzo, 2012; Miles and Miozzo, 2015). This trend has been associated with decreasing transportation costs and more widespread and more frequent utilisation of information and communication technologies. Nevertheless, perhaps the most significant contribution of services and in particular KIBS or producer services is related to the benefits they provide for other sectors in the economy, hence making an "indirect" but important contribution to economic development. This interaction with users of KIBS and other partners is referred to as "hidden innovation" (NESTA, 2006, 2007; Wood, 2009). This benefit that innovative services provide to users stems not only from joint development of the service but also from the frequency of interaction between users and producers (Sundbo, 1996; Monnoyer-Longe, 2011).

KIBS are important for economic development as they contribute directly to the creation of added value. They contribute to the national economy balance of payments through exports and have also given rise to dramatic growth rates of both employment and new firm formation. It is normally assumed that KIBS perform an important role in knowledge creation as well as in shaping regional competitiveness (Bryson and Daniels, 2015). However, it has been argued that it is difficult to test this relationship as it is difficult to develop objective measures of impact of

KIBS firms on client companies or regional competitiveness (Bryson and Daniels, 2015).

Reflecting upon the structural change of the UK economy as being largely driven by services and given that innovation has been recognised in the UK and internationally as one of the key drivers of productivity and growth, it is service industry innovation and KIBS in particular which is attracting significant attention (Gallouj and Djellal, 2010). Services innovation may have a direct effect on the economy via growth in employment and enhanced productivity (Mansury and Love, 2008) as well as exports (Bryson, 2007). However, as noted previously indirect benefits from services innovation may be felt through their enabling role in supporting innovation in other sectors including public sector (Muller and Zenker, 2001; Czarnitzki and Spielkamp, 2003; Wood, 2005; Bryson, 2010). The role of KIBS seems to be of particular significance in advanced regions where manufacturing and other services' competitiveness depends on knowledge provided by KIBS (Corrocher et al., 2009).

The main contribution of the geography related KIBS studies is the emphasis on the role which KIBS play in regional economic development. It has been widely acknowledged that in prosperous and large metropolitan regions KIBS stimulate innovation and economic growth (Hansen, 1994; Muller and Zenker, 2001; Simmie and Strambach, 2006; Aslesen and Isaksen, 2007). Little research, however, has been conducted with regards to the role of KIBS in more peripheral and in particular de-industrialised regions. The few studies of peripheral KIBS note that they are often of a poorer quality, less innovative, rely less on qualified personnel, are usually less specialised and depend largely on multinational enterprises (see for example O'Farrell et al., 1993; O'Farrell and Conway, 1994). Nevertheless, other empirical evidence suggests that KIBS in general (Beyers and Alvine, 1985) and in particular KIBS located outside major metropolitan regions (O'Farrell, 1993; O'Farrell et al., 1995) may make an important contribution to their region's export base by generating revenue from extra regional and international markets.

The perceived importance of KIBS in regional economies will depend on the approach to economic development and transformation. If development is defined in terms of job creation, it may well be the case that promoting employment in the public sector and consumer services may serve as an effective development strategy (Coffey and McRae, 1989). Examples of such approach to development can be found in many regional development initiatives in the UK. For example in the North East of England such initiatives have resulted in large increases of employment in service call centres[7].

In this research, however, development is associated with provision of high skill jobs, structural change towards knowledge based sectors, increase in productivity, accumulation of knowledge base and innovation. It is recognised that regions compete by achieving high levels of innovation, upgrading and growth rather than by promoting the lower costs of labour, land or capital (Malecki, 2004; Huggins, 2011). This agenda calls for attention to KIBS as KIBS are seen not only as an important source of innovation (Miles and Boden, 2000) but also as firms which supply knowledge products or use knowledge to supply their clients' knowledge processing activities (Miles et al., 1995; Muller and Zenker, 2001; Miles, 2005; Huggins, 2011). Recent academic thinking in the field of regional development points to the potential developmental role of the service sector (see for example Stimson et al., 2006, 385). Next section provides rationale for the main research question and related sub-questions and explains how this thesis contributes to the literature.

1.5 Main Research Question and the Contribution of the Thesis

KIBS represent the most rapidly growing sector in the majority of developed economies, providing jobs which may replace lost employment in declining manufacturing sector. The potential for regional development through KIBS has been discussed in section 1.4. However, little is known about the characteristics and the role of KIBS in de-industrialised regions. Therefore, main question this thesis aims to address is:

[7] Former Regional Development Agency- One North East proposes The Regional Call Centre Strategy as part of the overall KIBS strategy. The call centre industry already provides work for over 60,000 people in the North East; across more than 145 call centres-figures, which have increased over recent years.

What is the role of KIBS SMEs in promoting economic development in de-industrialised regions?

In order to answer the main research question empirical analysis will focus on the following themes and related research questions: First, KIBS can potentially constitute an important element of the economic base of the region given their propensity to export. In addition, even those KIBS which are not directly exported provide intermediate inputs for firms producing goods and services for export, hence they can be considered as "indirectly basic" activities (Coffey and Shearmur, 1997, 404). Both tradability and KIBS indirect role are likely to be influenced by KIBS location and characteristics of regional specialisation. Therefore, the first research theme and corresponding research question are related to KIBS location and their structural role in de-industrialised regions:

A. Location and Structural role of KIBS-<u>To what extent do KIBS depend on the industrial structure of their regions and to what extent are they tradable across space?</u>

Second, through instigating investment, innovation and technological change, KIBS play a key role in the economic development, facilitating economic change and adjustment (Coffey and Shearmur, 1997, 404). In addition, innovative KIBS promote innovation and knowledge accumulation in their clients. They draw from various sources of external knowledge aided by their own internal capacity to absorb this knowledge. For this reason, it is important to establish what factors drive KIBS own innovativeness. Therefore, the second research theme and related research question are related to external knowledge sources which aid KIBS innovativeness and internal capacity to absorb this knowledge:

B. KIBS systemic role - <u>What are the determinants of KIBS innovativeness?</u>

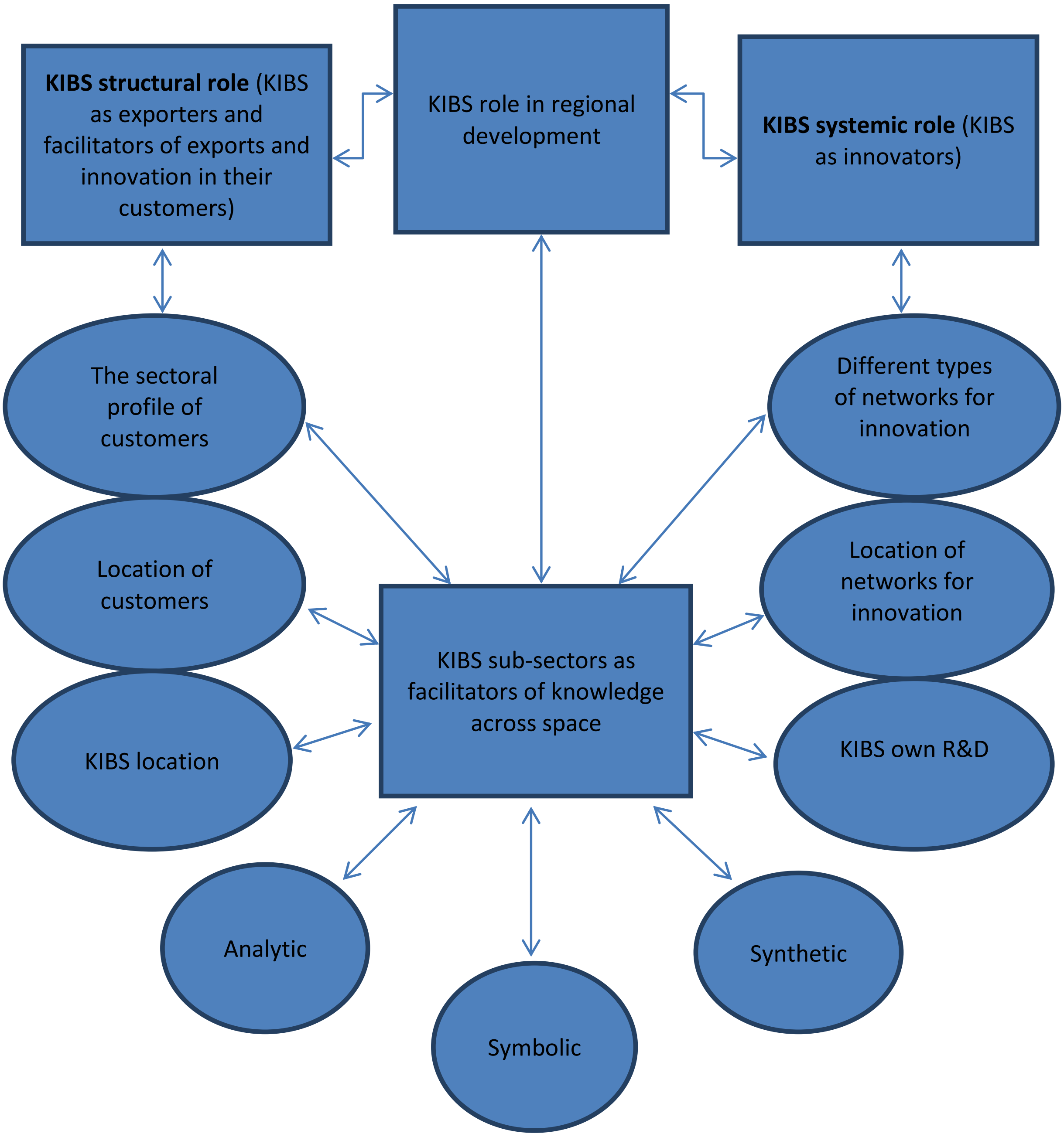
In addition, it must also be acknowledged that KIBS represent a diverse sector and individual KIBS sub-sectors differ in their role as facilitators of knowledge exchange across space. Thus, the third research theme and related research question attempt to establish the characteristics of sectoral differences and distinct knowledge bases underpinning KIBS sub-sectors:

C. The role of KIBS sub-sectors in diffusing knowledge across the space - How do different KIBS sub-sectors differ in their role as facilitators of knowledge across space?

The above three research questions are tackled in three empirical chapters. Chapter 5 looks at the location and the structural role of KIBS. Chapter 6 deals with KIBS own innovativeness and Chapter 7 deals with characteristics of KIBS sub-sectors and their respective knowledge bases.

The thesis models below (Figure 1) shows the overall conceptual framework which consists of: KIBS structural role, KIBS systemic role and differentiated KIBS sub-sectors. Additional research sub-questions will be developed in empirical chapters (5,6 and 7) and are related to: type and location of trade partners and KIBS location; type and location of external knowledge sources and KIBS own R&D as well as differentiation of KIBS sub-sectors into: analytic; synthetic and symbolic knowledge bases.

Figure 1: Thesis model



This research builds on the foundations of industrial location theories recognising at the same time that the narrow focus on agglomeration economies may be too restrictive in explaining KIBS functions in de-industrialised regions. In de-industrialised regions the role of vertical linkages (i.e. sectoral contiguity or intermediate demand) may be more useful in explaining KIBS behaviour and their role. In line with export base theory, KIBS income generating potential is also assessed. Further, this research places KIBS within national, regional and sectorial systems of innovation framework(s) to evaluate KIBS as knowledge facilitators and innovators. The importance of regional, national and international networks for their innovative success is investigated as well the importance of capacity to absorb knowledge from these networks. At the same time it is acknowledged that KIBS form a diverse sector differentiated by various knowledge bases, functioning differently across space.

Importance

Previous KIBS geography studies have either employed a macro-geographic approach which favours access to KIBS as opposed to innovative milieu approach which favours local presence of KIBS (Shearmur and Doloreux, 2009). A macro-geographic approach is in line with classic location theories. For example, Christaller (1933) as described in Shearmur and Doloreux (2009) suggests that high order services such as KIBS are not spatially bounded and are as a result able to reach markets well outside their immediate localities. On the contrary, innovative milieu approach states that the local presence of KIBS is important as it is believed that KIBS generate local innovative dynamics given their tendency to locate close to their clients (Shearmur and Doloreux, 2009). Indeed, a large number of studies confirm that proximity to customers plays a decisive role in KIBS location decisions (Koschatzky 1999; Muller and Zenker 2001; Keeble and Nachum 2002; Koch and Stahlecker 2006; Huggins 2008).

When assessing the role of KIBS in regional development, the issue of **location** is of prime importance (Coffey and McRae, 1989). Coffey and

McRae (1989) note that it is only those activities that are characterised by some degree of locational flexibility (“footlooseness”) who are likely to enhance the economic development prospects of peripheral regions. The idea of KIBS “footlosseness”, however, has been recently challenged by Doloreux et al. (2010) given inconclusive empirical evidence in the literature. Another shortcoming in the previous literature relates to the lack of emphasis on the role of vertical linkages and intermediate demand in KIBS regional specialisation (Meliciani and Savona, 2014). This research aims to address these gaps in the literature by investigating the relevance of different location theories and the importance of **intermediate demand**.

A somewhat related issue is KIBS **exporting potential**. Research has shown that KIBS located in large metropolitan regions (for example London) have strong international client base and help to promote and strengthen global connectedness of large cities (see for example Wood, 2002). Less is known about the exporting potential of peripheral KIBS as the latest research is more than a decade old (see for example Keeble et al., 1991; O'Farrell et al., 1996). This thesis aims to assess the exporting potential of KIBS in de-industrialised regions.

Further, it is widely acknowledged that KIBS rely on **knowledge** as a source of their competitiveness. KIBS are perceived as drivers of multilevel knowledge dynamics within a firm, sector and territorial context (Strambach, 2008). KIBS source knowledge from various external sources and combine this with the existing internal knowledge, as well as that from their clients (Thomi and Bohn, 2003). Many KIBS studies emphasise that the knowledge in question results from a co-production process involving clients (Miles et al., 1995; Antonelli, 1999; Windrum and Tomlinson, 1999; den Hertog, 2000; Muller and Zenker, 2001; Larsen, 2001; Bettencourt et al., 2002; Wood, 2002; Muller and Doloreux, 2007).

> *“They (KIBS) act as bridges for innovation and knowledge in their client firms, and in general as key agents within the innovation system”* (Muller and Zenker, 2001).

New knowledge generated by KIBS may be further implemented by a number of firms who are not KIBS clients (Aslesen and Isaksen, 2007) by imitating KIBS developed technologies and applying widely available KIBS practices and knowledge. However, little is known about the role of KIBS as knowledge facilitators in de-industrialised regions. This research aims to address this gap.

Another related KIBS feature is their own **innovativeness**, which is determined by their ability to accumulate knowledge and competence (Evangelista and Savona, 2003; Evangelista, 2006; Camacho and Rodriguez, 2008). Therefore, KIBS are not only seen as supporting innovation in their clients but as carriers of internal innovation activities such as scientific, technological, organisational, financial etc. (Doloreux et al., 2010, 192). Still, little is known about the role which KIBS play as innovators in de-industrialised regions. This research sets out to establish which factors induce innovation in KIBS. In summary, following from and extending upon the above mentioned studies, this research aims to investigate exporting, knowledge facilitating as well as innovating role of KIBS SMEs in de-industrialised regions.

Originality

A unique aspect of this thesis is that it focuses on the role of KIBS SMEs in development of de-industrialised regions whereas most previous research concentrates on KIBS located in metropolitan regions. To examine this role, the approach adopted in this research proposes a new conceptual framework which considers KIBS SMEs as exporters, knowledge facilitators and innovators. Unlike most previous studies, which usually concentrate on only one aspect of KIBS role, for example either innovation, or exporting or knowledge co-production (while neglecting the remaining two), this thesis combines all three aspects. In other words, the problem of conceptual separation is addressed by integrating the fields of regional science and innovation. Moreover, in this thesis KIBS are not perceived as a homogenous group but empirical analysis provides insights into similarities and unique characteristics of KIBS sub-sectors and their respective knowledge bases. The analysis is based on the original survey. The firm is the basic unit of analysis as exporting; knowledge facilitating and innovating roles are all performed by individual firms.

1.6 Thesis Organisation

The structure of the thesis is that it comprises eight chapters. The research foundations are developed in Chapters 1, 2 and 3. Chapter 1 sets the scene for the study, proposes justification for the current study and defines KIBS and de-industrialised regions. Chapter 2 builds a conceptual framework as a basis for assessing the role of KIBS in regional economic development in subsequent empirical chapters. Chapter 2 discuses some theories related to the rise of the service economy, provides an assessment of the regional science/geography literature on KIBS and related literature on industry location. Chapter 2 further discusses systems of innovation framework and covers main KIBS innovation literature and related geography of innovation literature. Chapter 3 provides a review of the recent economic geography of the two chosen case study regions. Chapter 3 also analyses recent changes in the UK KIBS employment pattern on a regional level. Chapter 4 is the methodology chapter.

Main empirical analysis of the survey data is organised in Chapters 5, 6 and 7. KIBS structural role is addressed in Chapter 5 which aims to establish their exporting potential and the role of intermediate demand (manufacturing and other services). Chapter 6, in line with the rest of the innovation literature and geography of innovation literature, establishes what factors facilitate innovation in KIBS. The role of absorptive capacity, as measured by investment in R&D, is taken into consideration as well as engagement in various types of regional and extra-regional networking. Chapter 7 tests the existing typology of knowledge bases on KIBS sub-sectors. In line with sectoral perspective and variety of knowledge bases literature, Chapter 7 establishes to what extent the existing taxonomies such as analytic, symbolic and synthetic differentiate between KIBS sub-sectors. Chapter 8 is a concluding chapter. Chapter 8 includes the discussion of main findings, contribution to the literature, limitations of the study, policy implications and suggestions for further research.

The next chapter proposes a new conceptual framework related to the role of KIBS in regional economic development.

CHAPTER 2: ECONOMIC GEOGRAPHY OF KIBS

2.1 Introduction

The purpose of the proceeding literature review is to develop a new conceptual framework which will be used to inform analysis of the survey data. The conceptual framework developed in this chapter motivates the main research question this thesis aims to answer:

What is the role of KIBS SMEs in promoting economic development in de-industrialised regions?

This chapter will also critically appraise the state of knowledge on KIBS and propose how gaps in the existing knowledge will be addressed in the thesis. The current state of knowledge on KIBS follows several strands of research traditions namely: innovation research, the sociology of knowledge and science, management and organisation studies, economic theories, regional geography as well as interdisciplinary research on the new networking economy and informational society (Windrum and Tomlinson, 1999; Miles, 2003). However, two most prominent strands of KIBS research are: (i) KIBS innovation and (ii) KIBS geography and regional science. The thesis will concentrate and expand upon these two strands of literature and will develop three themes that will inform the empirical analysis in chapters 5, 6 and 7. These themes are: (i) Location and structural role of KIBS; (ii) KIBS own innovativeness and (iii) The role of different KIBS sub-sectors in diffusing knowledge across space.

Innovation scholars have often been preoccupied with establishing whether services are innovative and if the answer to this question is affirmative, to what extent innovation in services differs to that in manufacturing. Studies from geography and regional science focus instead on location patterns of KIBS and often provide implications for regional economic development. Geographers acknowledge that more peripheral regions may be disadvantaged with regards to supply and quality of KIBS provision.

Recently, a number of studies from the innovation stream have accepted that KIBS operate in a varied geographical context facing different issues due to regional differences in historical and institutional set up. However, empirical evidence related to KIBS innovation, which takes geographical perspective, is still sparse due to persistent separation between the above mentioned scholarly perspectives. This is because scholars come from different research traditions, ask different research questions, use different data sources and apply different methodologies. For example, geographers may ask: “Why do KIBS cluster?”; “Do KIBS contribute to local economic development?”, whereas innovation scholars may ask: “Are KIBS innovative?”; “What factors impact upon KIBS innovativeness?” Innovation scholars consider KIBS as an “object” group since the emphasis is on KIBS dynamics and geographers consider KIBS as a “treatment” group emphasising their role in local economies. This role is often perceived by geographers in relation to the contribution KIBS make to their clients’ innovativeness as well as in relation to their exporting potential.

This research aims to bridge the gap between the two perspectives by developing a new conceptual framework and providing original empirical evidence with the aim of enhancing our understanding of the KIBS’ role. This is important since the KIBS’ contribution to regional economies stems from their own innovativeness and their own exporting potential but also from their ability to act as facilitators of knowledge and innovation in their clients, promoting their international success.

Moreover, it is known that KIBS act as innovators but it is still unclear which factors impacts upon their innovativeness. It is also known that KIBS act as facilitators and co-producers of innovation, not only in collaboration with their clients, but with other actors and institutions in the innovation systems be it regional, national and international. However, sufficient understanding about the relative importance of these relationships for KIBS success is lacking.

This chapter will proceed by setting the scene in the context of “New service economy”, it will then continue by assessing KIBS literature as well as other related theoretical and empirical literature on: industrial location;

national, regional and sectoral systems of innovation; clusters and networks; absorptive capacity and differentiated knowledge bases. The proceeding review considers a rather wide span of theoretical and empirical contributions since the literature on KIBS follows many strands but lacks an overall conceptual framework. This research proposes to shift the narrow focus on industrial location towards developing and adopting a more broader, economic geography theoretical and methodological framework. The next section looks at the role of services and KIBS in the context of economic restructuring of advanced economies.

2.2 The New Service Economy?

2.2.1 Services and Productivity

The rapid growth of services from the late 1960s and early 1970s (Metcalfe and Miles, 2000) and the associated decline of manufacturing has been termed by researchers as “deindustrialisation” or “tertiarisation” or rise of “service economy” (Miles, 1993, 655). However, during the 1960s, 1970s and early 1980s very few academics were interested in services. In 1986 Riddle argued that the service sector is one of the least understood portions of the economy (Riddle, 1986, 6). This neglect of services in academic research was influenced by classical political economists Adam Smith, David Ricardo and Karl Marx who treated services unfavourably compared to manufacturing. This is not to say that services were not studied before the 1970s. Indeed, one of the most important early studies is Greenfield’s study on producer services (1966). This was followed by Bell’s work on post-industrial society (1973) which influenced Gershuny’s (1978) work on the new services economy. However, there were not many researchers who were interested in this line of work as most attention was concentrated on manufacturing.

The traditional perception of services as laggards in terms of productivity, technology and innovation, dates back to Adam Smith (1776). Adam Smith implied that services offered little scope for the division of labour and little scope for the growth of productivity in the economy. Smith did not refer to services as a sector in its own right but instead offered the distinction between productive and unproductive labour. Unproductive labour, according to Smith includes professions such as: servants, lawyers, writers, medical, musicians and many others belonging to the tertiary sector. The implication of Smith's reasoning on services is that spending on unproductive labour diverts resources away from the investment in productive capital, which in turn results in a slower economic development and growth.

Smith's distinction between productive and unproductive labour was later shared with John Stuart Mill, Karl Marx and David Ricardo. Centuries later and in a similar manner other scholars including Fuchs (1968) and Baumol (1967, 1985) interpreted increased service employment as a consequence of low labour productivity of service work compared to material production and developed an argument known as "cost disease". Baumol (1967) explained the differences in productivity growth among sectors as a result of the role played by labour input in different sectors. For example, in progressive sectors such as manufacturing labour is a means to an end, whereas in stagnant sectors (identified as part of services) labour is an end in itself. Therefore, in an economy where wages are set according to the growth in productivity in the manufacturing sector, wages are also expected to grow systematically over time in less dynamic sectors. It is assumed that the demand for services is inelastic to price (i.e. demand is not expected to decrease as the price increases and vice versa) and that demand will also continue to increase with an increase in living standards (i.e. demand for services is income elastic).

Since the demand for services is income elastic (i.e. demand for services will increase with increasing accumulation of wealth in the economy over time) there will be a steady transfer from productive to non-productive parts of the economy. This transfer from productive to non-productive activities relates to a shift away from productive manufacturing but also away from more productive towards less productive services. Baumol's cost disease argument predicts a decrease in economic growth due to slow growth of productivity in services and its growing influence over productive sectors. In other words, the effect of high income elasticity of demand, low price elasticity of demand and low productivity of services will translate into an increasing proportion of national income and consumption being allocated to the service sector.

Pavitt (1984) also argued that services are innovation laggards. Pavitt located all services in one of the four sectoral categories[8] that he identified, namely supplier dominated firms. Supplier dominated firms can be found mainly in personal services such as restaurants, hotels and public and social services such as education and healthcare. Overall, supplier dominated firms make only a minor contribution to their process technology whereas most innovation comes from suppliers of equipment, information and materials.

Recent empirical evidence (Maroto and Rubalcaba, 2008) shows dualism related to services productivity on the sub-sectoral level. Maroto and Rubalcaba (2008) use traditional productivity statistics from the OECD and note that some services register similar or even higher productivity growth than some other industries and their results also differ by countries. This is the case with transport services, computer and related services, communication services and financial services. However, other services such as number of business services, distributive trades, tourism, personal services, perform relatively badly (Maroto and Rubalcaba, 2008).

In summary, academic and policy makers increasingly acknowledge the ability of services to create value. It is certainly true that some services create low skilled jobs but other services and especially producer services or KIBS create opportunities for high level skilled work such as highly paid and intellectually stimulating managerial and professional work (Baumol, 2010).

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[8] Pavitt's taxonomy consists of four categories of industrial firms:
(1) **Supplier-dominated**: includes firms from mostly traditional manufacturing such as textiles and agriculture and many services which rely on sources of innovation external to the firm.
(2) **Scale-intensive**: characterized by mainly large firms producing basic materials and consumer durables, e.g. automotive sector. Sources of innovation may be both internal and external to the firm with a medium-level of appropriability.
(3) **Specialized suppliers**: smaller, more specialized firms producing technology to be sold into other firms, e.g. specialized machinery production and high-tech instruments. There is a high level of appropriability due to the tacit nature of the knowledge.
(4) **Science-based**: high-tech firms which rely on R&D from both in-house sources and university research, including industries such as pharmaceuticals and electronics. Firms in this sector develop new products or processes and have a high degree of appropriability from patents, secrecy, and tacit know-how.

2.2.2 Income Growth

Gershuny and Miles (1983) in their study of the occupational distribution of employment in France, Ireland, Italy and the UK (1983) argue that during the 1960s and 1970s, changes in the occupational distribution of employment have resulted more from changes in occupational structure within the sectors rather than changes in demand between them. This qualifies the "sectoral shift" or the Fisher-Clark thesis[9]. It logically follows from the Fisher-Clark model of development that as people become richer, they will demand more services such as good education, greater concern for health, greater pursuit of leisure and exercise and greater demand for international travel. Marshall and Wood (1995) also state that an important explanation for services and KIBS growth comes from the increased business and consumer demand for services provision caused by increased wealth creation in capitalist societies.

Indeed, empirical evidence shows that in countries with higher per capita income, the service sector employment tends to be higher (OECD, 2005). This is because many services have high income elasticity, in particular leisure, education, health and travel. According to Rubalcaba (2013), there is a strong relationship between GDP and employment in services, although it should be noted that this relationship does not apply to all countries. In Latin America, for example, correlation between GDP per capita and services employment is not observed (Rubalcaba, 2007). At the same time, empirical evidence shows that demographic changes in the richest economies, such as those related to ageing population, have increased demand for particular types of services such as health care and personal services (Rubalcaba, 2013).

Victor Fuchs (1968) studied USA evidence and supported (at least in theory) the connection between services growth and per capita income growth. Fuchs was mainly thinking about consumer and public service growth and he also argued that the service sector itself would need to go

[9] As early as 1935, Allen Fisher had suggested that economic progress would lead to the emergence of a large service sector, which followed the development of a primary and secondary sector. Later, in 1940, Colin Clark developed this theme to create the Clark-Fisher development theory, also called the Fisher-Clark model.

through an evolutionary process if growth rates were to be maintained. Recently, such process has resulted in changes to both services provision and services productivity aided by the IT revolution.

2.2.3 Technological Change and ICT

In a similar light but from an information technology perspective, Hepworth (1987) saw a new phase of economic development brought about by developments in information technologies. Technology and innovation have revolutionised the tertiary sector whereby some sectors have benefited from economies of scale, owing to increasing use of new technologies. These include financial services, health care, distribution services and telecommunications (Rubalcaba, 2013). Engineering, computer and related activities, e-commerce and business services are most strongly associated with technological revolution. These services facilitate the production, expansion and use of new technologies. Many new services such as ICT have been the forerunners of internet-related businesses (Rubalcaba, 2013).

Howells (2000) notes that the role of internet and web based services and the growth in high technology environmental services indicate that certain types of services are now taking a more proactive, leading role in the economies. Research attention subsequently turned to this particular service sub-sector-KIBS. Prior to the 1970s, KIBS were also largely dismissed as being unimportant and unproductive (Shearmur, 2012). However, KIBS are playing an ever more important role in the UK economy. From 2000 to 2011, for example, employment in KIBS rose from 13.6% to 15.1% as a proportion of total UK employment (OECD Science, technology and industry scoreboard, 2013). KIBS are amongst the most innovative subsectors in the service economy as well as an important influence on the innovation activities of client firms (Miles, 2005). Miles (2000) points to a number of studies which show that KIBS are associated with economic growth, allowing him to argue that KIBS can be treated as a factor of production alongside capital and labour.

As services are often perceived as important contributors to the raising of productivity in modern economies, this supports the idea of a rise of a service economy independently from the industrial base. The most influential proponent of such a view is Daniel Bell (1973) who presents a vision of post-industrial society dominated by knowledge based, educated white-collar workforce. Nevertheless, according to Bryson and Daniels (2002), although manufacturing employment has been decreasing, productivity improvements have meant that the manufacturing output has actually risen. This implies that contrary to the “de-industrialisation” thesis, technological change is leading to a process by which services spring out of goods and vice versa, hence it can be argued that an increase in employment in business services is an outcome of an increased technical and social division of labour within production and that services and production cannot be separated.

2.2.4 Division of Labour and Organisational Change

The growth of numbers of KIBS enterprises has, in part, been explained by the need of companies to focus on core competencies and the subsequent division of labour which has led to an increase in outsourcing, later including offshoring, and the emergence and growth of new organisations. Another source of increasing KIBS formation is the creation of new consultancy and other similar companies by professionals who have been “downsized” (Wood, 2002). Others emerge out of university departments and government laboratories (European Foundation for the Improvement of Living and Working Conditions, 2006).

The outsourcing perspective implies that services growth is not a result of real increases in demand for services but a result of reorganisation of jobs and division of labour. Hence, KIBS functions such as accounting, advertising, IT and distribution which were historically internalised in large corporations have been increasingly externalised. This enables manufacturing firms to focus on their core competencies and outsource non-core functions. Hence, firms increasingly require KIBS firms to undertake such functions that are not available in-house (Huggins, 2011). Apart from improving competitiveness through outsourcing of non-core functions firms are at the same time able to reduce costs (Miles, 2005). Moreover, as firms contract out these functions which do not form part of the core competencies, new opportunities for KIBS firms emerge. The extent of outsourcing varies across KIBS activities with legal activities perhaps the least outsourced and ICT activities becoming the fastest growing outsourced function amongst KIBS (Doloreux, et al., 2008).

Williamson's (1979) theory of transaction costs corresponds to the idea of outsourcing services. He argued that those transactions that exhibit high uncertainty, high frequency and high asset specificity are more likely to be conducted in house whereas those which are less uncertain, less frequent and less asset specific are easier to outsource to external firms or agencies. The concept of flexible specialisation (Piore and Sabel, 1984) has also been used to explain gains from organisational changes related to outsourcing, whereby gains in specialisation derived from more flexible production systems have been channelled towards outsourcing of services.

2.2.5 Innovation and Globalisation

Huggins (2011) asserts that the growing importance of innovation often associated with the ability of firms to access external knowledge from both formal and informal networking, whether within a particular locality or across spatial boundaries, creates opportunities for KIBS growth. The growth of KIBS reflects an increased demand for knowledge as a result of changing competitiveness conditions. Firms require KIBS to access knowledge that is unavailable and not accessible within the boundaries of a firm (Huggins, 2011). This trend is positively related to outsourcing of KIBS. Hence, although KIBS firms have grown as a result of outsourcing of core competences, their growth is also associated with increasing demand for service based knowledge and innovation (Huggins, 2011).

The effects of globalisation also promote KIBS growth. KIBS may be pulled into international markets as a result of the location decisions of their existing customers and the requirement to follow them (Huggins, 2011). This is particularly the case with well-established legal services and accountancy firms (Wood, 2006). The growth of services in international trade, however, is not limited to KIBS following customers. Internationalisation of KIBS may form part of the cost reduction strategy whereby KIBS firms are reallocated to lower cost locations overseas

(Huggins, 2011). As a result, the emergence of offshoring has opened up new competitive opportunities for developing economies. It should be noted that international trade in services is partially limited due to trade regulations. Compared to the traded goods, services traded globally comprise 20-25% of trade (Rubalcaba, 2013). Therefore, a large proportion of trade in services can be partially explained by the Foreign Direct Investment (FDI) which is complementary to the actual trade in services (Rubalcaba and Toivonen, 2013).

It can be concluded that both innovation and globalisation of KIBS activities are endogenous elements in economic development. On one hand, increased demand for knowledge and knowledge based activities both at home and abroad drive up demand for KIBS. On the other hand, KIBS themselves promote accumulation of knowledge and innovation.

2.2.6 Services Integration

Gershuny (1978) was one of the early scholars who challenged the whole idea of separation of services from manufacturing. In line with this reasoning Walker (1985) claimed that many services are involved in material production. Gershuny (1978) and Walker (1985) considered the contribution of services mainly in relation to manufacturing. In a similar manner, Baumol (1985) argued that producer services serve manufacturing supporting function rather than consumption function. In summary, it has been argued that services are inseparable from manufacturing. This is because they mainly serve manufacturing clients but also because they spring out of manufacturing functions.

Daniels and Bryson (2002) also question the validity of a clear-cut distinction between manufacturing and services. Daniels and Bryson (2002) call for a reconsideration of the relationship between services and manufacturing arguing that the division between knowledge-based parts of the production process (or service elements) and the physical processes associated with the manufacture of products has become blurred. An interesting strand of the literature argues that manufacturing is going through a process of “servitisation” (Neely, 2007) but this only suggests that services are being applied to manufacturing as an additional element.

Contrary to this view, Bryson and Daniels (2015) argue that the application of services to manufacturing is not simply a process of application but one of transformation. This process has, according to Bryson and Daniels (2015), led to a hybrid production system and hybrid products.

Wood (1986) was one of the first scholars to question the dependence of KIBS on manufacturing. Wood (1986) notes that complexity and growth of KIBS mirrors the rise in KIBS expertise tailored to serving other service functions. In line with this reasoning, Marshall and Wood (1995) relate the developments in the UK service sector to the rise of the financial sector. With reference to the UK economy and London specifically in the 1980s and 1990s, the nature and spatial dynamics of the financial sector ("the power of money") as argued by Marshall and Wood (1995) drive supply and demand for other KIBS.

"*The globalisation of financial markets which has been encouraged by the weakening of the national regulations resulted in innovation of financial products and produced rapid growth in international finance during the 1980s which particularly in the US and UK spilled over into demand for domestic financial services and related consultancy, legal and real estate service*" (Marshall and Wood, 1995).

However, as Wood (2010) points out, regional industrial profiles drive specialisation in KIBS. In some regions, such as London and the South East, KIBS do indeed depend on other services (financial and related services, both UK and international), whereby their counterparts in de-industrialised regions may be more dependent on local manufacturing and public sector demand.

In summary, a key driving force in the shift towards services is the integration of services in all kinds of productive processes, manufacturing as well as other services. Therefore, the "New Service Economy" does not refer to the growth of services as a separate sector, but rather to the growth of service activities embedded within different economic activities (Rubalcaba, 2007). What is new is the increasing presence of services in business and consumption processes and the capacity of services to become innovative, productive and tradable (Rubalcaba, 2013). A key question is how and to what extent such transformation is occurring in different regional settings?

2.3 Geography of KIBS

2.3.1 KIBS Location Patterns

Geographers were amongst the first scholars who acknowledged KIBS growth and uneven concentration patterns. They have been concerned with the sector location and implications for regional development. For example, British geographers; Peter Wood, Neil Marshall, Nigel Thrift and Peter Daniels and the American and Canadian geographers; Bill Beyers, William Coffey, Mario Polese and Richard Shearmur have all made important contributions towards our understanding of the service sector geographical and corporate set up and tendencies towards geographical concentration.

A general consensus in the literature is that KIBS tend to locate in large metropolitan areas (Marshall and Wood, 1995; Coffey and Shearmur, 1997; Keeble and Nachum, 2002; Daniels and Bryson, 2005; Wood, 2006; Shearmur and Doloreux, 2008). Howells and Green (1988) showed that there has been a major shift in employment towards business services in the UK, resulting in 744,000 additional jobs created between 1971 and 1984 with the highest concentration in London, the major cities and some major provincial centres. London and surrounding areas, as classified by authors into “conurbation dominants” and “provincial dominants” accounted for 53% of all producer service employment. Howells and Green (1988) refer to two categories of locations: an “economic elite” of locations, chiefly in the South, and a few medium-sized towns and “established business centres”, predominantly in the major conurbations and regional centres such as Glasgow, Tyneside, Liverpool, Manchester, West Yorkshire, Sheffield, Birmingham, Bristol, Southampton, Portsmouth, Exeter and London.

Later analyses confirmed the pattern of business services concentration in London, the South-East and several major regional centers. For example, Keeble et al. (1991) found that 62% of “other business services” in the South East region in 1989 are highly concentrated (calculated through location quotients) in London, the South East and the regional centres of Manchester, Birmingham, Glasgow, Edinburgh, Aberdeen and Cardiff. By employment level, Keeble and Bryson (1996) showed that 43% of the UK services are located in London and 62% in London and the South East. For some specialist business services the concentration is even higher, with market research and management consultancy, for example, located 80% in London and 93% in London and the South East (Keeble et al., 1991).

Fifteen years later, Wood (2006, 239) notes that KIBS are especially dominant in central London, where they make up three quarters of its knowledge intensive activities compared to only two thirds in the core cities (i.e. Bristol, Leeds, Birmingham, Manchester, Newcastle and Liverpool). Moreover, with reference to KIBS and their impact on regions, some authors suggest that the rapid growth of KIBS in 1990’s has contributed towards widening of existing disparities between regions with the Greater South East dominating the rest of the UK (Chadwick et al., 2008).

The importance of urban centres as primary business locations has been challenged by the emergence of company downsizing, decentralization, outsourcing and a greater role of SMEs in the economy (Bennett et al., 1999). This argument goes in hand with a more flexible and footloose pattern of KIBS location. This has been purported by the finding which shows that services engage in non-interactive patterns of innovation such as adoption of technology (Sundbo and Gallouj, 2000; Den Hertog, 2000). The development and adoption of ICT has important implications for the way some services are delivered across space and for the timing of this delivery. The related argument concerns the possibility of increased specialisation of services due to separation between the development and delivery of service enabled by ICT (Corrocher et al., 2009).

Indeed, Keeble and Nachum (2002) noted the existence of “counterparts”, or decentralised KIBS locations in some rural areas and smaller towns in the UK. Nonetheless, a number of studies found that corporate headquarters continue to be located chiefly in the major urban centers (Marshall and Green, 1990; O'Farrell and Hitchens, 1990; Marshall, 1994), whereas SME development tends to be restricted to within 50 to 80 kilometres from headquarters or major centers (Coffey and Polese, 1987; Marshall et al., 1987; Marshall and Green, 1990; O'Farrell et al., 1993; Hitchens et al., 1994; Marshall, 1994). Wood et al. (1993, 625) found that research and management consultancy firms "are predominantly urban-based" whereas those located in more rural or small-town environments usually benefit form modern communication that allows access to major economic centers.

Majority of the above studies on the economies of metropolitan areas with high concentration of high-order services base their analysis on a pure model of agglomeration which presumes no form of cooperation between actors beyond what is their individual interest in a competitive environment. This model is based on modern urban economic theory. The assumption which the above studies make is that there is only one model of spatial clustering, whereas in the real world different types may be found. Theories which aim to explain persistent patterns of KIBS concentration in major urban canters and related theories which concentrate on prospects for KIBS decentralisation are assessed in the next section.

2.3.2 KIBS and Industrial Location Theories

Agglomeration and Global Cities

Classical and neo-classical models of location suggest that firms choose specific locations with the aim of minimising transportation costs. Most traditional models adopt the assumption that firms behave in a rational manner whereby they seek to minimize costs and maximize profits. Alfred Webber's model of industrial location, as presented in McCann (2001), shows that if a firm is able to locate anywhere, assuming that this firm is rational, it will locate where it can earn most profit. Given that all prices of inputs and outputs are exogenous and that they do no vary across space, the only factor which affects firms' profitability will be distance to markets and factors of production. While this and related models concentrate on the cost of factors of production as well as transport costs they do not take account of the possible spatial variation. In other words, these models pay no attention to the possible variation in both availability and quality of factors of production (such as labour), nor the importance of locating close to other firms in similar or related industries.

Alternative models of industrial location have been developed in the economic geography literature. Related theories of agglomeration economies date back to the contribution of Marshall in the late 19th century. These are often divided into two distinct categories of agglomeration economies namely: urbanisation economies and localisation economies[10]. Urbanization economies derive from the location and are external to the firm but internal to a local context (be it a city, region or nation, but usually a city). Localization economies are external to the firm but internal to the industry or group of industries that trade directly with each other. In relation to urbanisation economies there is no consensus about the city size most conducive to innovation but cities lacking sufficient diversity or large clusters (or at least some major institutions such as universities and research laboratories and good transport and IT connections) may not provide propitious environment for innovation (Shearmur and Doloreux, 2016).

According to Meliciani and Savona (2014) the sources of agglomeration economies are to be found in: (i) localisation externalities stemming from sectoral density; (ii) urbanisation externalities which arise out of urban and population density and (iii) Jacob's externalities deriving from a variety of activities within urban context. Jacob's externalities tend to be higher in regions with relatively higher related rather than unrelated variety of urban activities (Frenken et al., 2007).

Coffey and Polese (1986) are amongst the first researchers who developed a model of KIBS location. They emphasize the importance of several factors which influence KIBS location namely: availability of skilled labour; the distance and the ease of delivering services to markets and the presence of firms from related industries such as finance and other

[10] Urbanization economies are associated with clustering of dissimilar firms in large cities and localization economies with clustering of similar firms in specific locations (Hoover, 1948).

services. Since labour costs are the most significant expense for KIBS, the availability of skilled labour is perceived as one of the most important factors in KIBS location decisions (Coffey and Polese, 1987). In summary, in metropolitan areas KIBS benefit from agglomeration effects associated with (from a supply side) a large pool of highly skilled labour and (a demand side) access to national and international markets and proximity to clients (Bennett et al., 1999). Other studies have claimed that it is largely effects of the economies of urbanization which influence KIBS concentration (see for example, Coffey and Shearmur, 1998) although Gordon and McCann (2000) find that for London based KIBS attach higher value to sector-specific localisation economies rather than to more general urbanisation economies.

It has been suggested that services not only benefit from agglomeration economies but at the same time reinforce their effect (Bennett et al., 1999). Coffey and Bailly (1992) and Wood (1991) argued that KIBS act as stimulants for agglomeration. This is because demand for information and knowledge generated by some services and strong face-to-face interaction between businesses and their service suppliers, localise interactions and reinforce the forces of agglomeration. Lindahl and Beyers (1999) further argued that business services are a “stuck” category, fixed to their location, which also promote a competitive advantage of that location. They suggest a particular importance of locations “rich” in business services as attractors of creativity and stimulators of information exchange.

More recently, few KIBS empirical regional agglomeration studies from Canada show somewhat conflicting results. Shearmur and Doloreux (2008) argue that KIBS which serve manufacturing base will be sufficiently close to their de-centralised clients even when they operate from metropolitan locations. Contrary to this finding, Polese and Sheramur (2006) emphasise that some KIBS actually follow their manufacturing clients outside the metropolitan locations. Thus, the question is whether KIBS tendency to cluster in big cities is outweighed by the centrifugal forces to follow manufacturing clients if they are not located in metropolitan areas (Meliciani and Savona, 2014)?

Related body of literature emphasises benefits of urbanisation economies for KIBS in the overarching concept of polycentric Mega-City Region. This literature combines different theoretical approaches namely; John Friedman's World Cities, Saskia Sassen's Global Cities, Peter Taylor's World City Network and Manuel Castell's Space of Flows. Sassen's (1991, 2001) approach draws from the Christallerian's (1933) hierarchy of service centers with the high order services locating in larger cities, from where they draw upon benefits of agglomeration economies and deliver their services across large distance.

So far, there is no evidence that knowledge economy spatial functions are deconcentrating but instead continue to concentrate in Mega-City Regions which are series of anything between 10 and 50 cities and towns physically separate but functionally networked, clustered around one or more larger central cities (Hall and Pain, 2006). It is argued that clustering of economic activities promotes deepening and widening of knowledge driven by the globalisation of markets and services. This is in turn facilitated by developments in information and communication technologies (Hall and Pain, 2006). The presence of corporate headquarters in large cities generates demand for KIBS (see for example Sassen, 2000; Hansen, 2001) but also causes a spin-off the talent to form new KIBS firms (Bryson et al., 2004).

As noted above, studies which base their analysis on the model of pure agglomeration assume that there is only one type of clustering in space. Such models neglect the role of trust, long-term relationships and co-operation between firms and other actors in the economy. In addition, what is lacking is a perspective on how firms may change their pattern of location in time. This issue has profound implications for prospects of KIBS led regional economic development.

2.3.3 KIBS and Regional Economic Development

Closely related to KIBS location is the issue of KIBS' potential role in supporting regional economic development. Correlation between overall economic performance and share of KIBS employment was noted by Simmie and Strambach (2006). They pointed out that the concentration of

KIBS in metropolitan regions offers important advantages for knowledge diffusion and knowledge spillovers. In the USA, Hansen (1994) argued that the growth performance of the US cities was related to the size of the KIBS sector. Muller and Zenker (2001) claimed that KIBS in five regions in France and Germany create a “virtuous circle” as they learn from their clients, codify this knowledge and act as bridges between the generic knowledge and the specific needs of the firms. Aslesen and Isaksen (2007) revealed that in Oslo KIBS act as “motor of competence” and stimulants of innovation.

It has been argued more recently that *"despite their tendency to gravitate towards metropolitan regions KIBS can potentially act as catalysts for economic growth in the peripheral regions"* (Wernerheim and Sharpe, 2003, 470). It follows that KIBS can be attracted to de-industrial regions where they will contribute to regional growth. This argument is based on the assumption that KIBS are "footloose", in other words unlike some industries which depend on physical proximity to raw materials or markets KIBS are free of location constraints. This thinking goes in hand with some more recent arguments which attribute reduced need for physical co-location between KIBS and clients due to developments in transport and communication technologies.

Transportation and telecommunication advantages imply that most KIBS can be exported. However, some researchers argue that telecommunications and transportation improvements only benefit KIBS from large urban areas as they are able to compete with more peripheral firms in accessing their local markets (see for example, Kirin et al., 1990). This approach has recently largely given way to the realisation that, even if KIBS grew faster outside metropolitan areas in 1970s and 1980s, this may have more accurately reflected the delayed tertiarisation of some regional economies and not a fundamental shift of KIBS away from metropolitan areas (Doloreux et al., 2016). Wernerheim and Sharpe (2003) provided empirical evidence from Canada which suggests that *“it is unlikely that producer services in the Canadian metropolitan system are sufficiently "footloose" to respond to regional public policy initiatives by creating employment incentives to migrate to peripheral regions”* (Wernerheim and Sharpe, 2003, 484). The “footloose” industry hypothesis has also been recently criticized by Doloreux et al. (2010) for its lack of empirical grounding.

KIBS tendency to gravitate towards large metropolitan regions should not necessarily be problematic. If access to KIBS by SMEs in peripheral areas can occur over large distances, then innovation systems *connectivity* to other regions is important and lack of local KIBS should be of little concern to local policy makers (Doloreux et al., 2010). However, KIBS presence may be important because of their contribution to local knowledge base. KIBS knowledge generating function represents a positive externality meaning that other firms will benefit from KIBS generated knowledge and expertise. As a result overall regional innovative capability of the region will be enhanced. This argument is in line with positive long term externality fostering competition and reducing regional disparities (Malecki, 1981). This view is also in line with Cooke and Leydesdorff (2006) who suggest that KIBS are a key component of local innovation systems. Even if they are not necessarily growing fast, KIBS contribute to the overall functioning of the territorially embedded networks and innovation dynamics.

And while some empirical evidence shows that KIBS located in peripheral regions can make an important contribution to the export base and this includes both inter regional as well as international trade (see for example Beyers and Alvine, 1985; Stabler and Howe, 1988; O’Farrell, 1993) there is no consensus in the literature regarding KIBS induced growth in de-industrialised regions. On the one hand, a number of researchers suggest that there is a possibility of regional development via decentralisation of KIBS (see for example Keeble et al. 1991; Beyers, 1992; Marshall and Wood, 1992; Bodenman, 2000). On the other hand, it is argued that KIBS capability of enhancing economic development prospects of peripheral regions is rather weak (see for example Coffey and Polese, 1987, 1989; Daniels, 1995, 1998; Bennett and Graham, 1998; Bennett et al., 1999). The issue of KIBS led growth and development in peripheral regions is closely related to prospects for KIBS decentralisation. It should be noted that a number of geography related KIBS studies do consider KIBS decentralising tendencies. The prospect of KIBS decentralisation is particularly important from the regional economic development perspective. However, these studies fail short of explaining how location decisions of KIBS change in space and time (Sjoholt, 1993; Wernerheim and Sharpe, 2003).

Product Life Cycle

Spatial division of labour and the product life cycle theory associated with Vernon's research (1966) has been used to explain services decentralisation. This theory has been originally developed to explain the behaviour of manufacturing firms. It is argued that routine service functions of large corporations will, during the later stages of product life cycle, decentralise to rural locations taking advantage of lower wages and land costs (Hepworth, 1990). This explanation also relates de-centralisation of services to innovations in telecommunications technology as well as advances in transport (Glasmeier and Howland, 1993).

In line with this thinking a number of studies argue that it is the relationship between head office locations of large firms and corporate control of their branch offices which are vital for our understanding of KIBS spatial distribution. For example, Marshall (1982) and Illeris (1989) argue that many regions will be severely constrained with regards to the demand for local KIBS. This is because more peripheral regions operate as "branch plant" economies meaning that they have a high concentration of externally owned multinational firms whose headquarters locate in core metropolitan regions. These branch plants have very few linkages to local economies since it is their headquarters that purchase KIBS services from core metropolitan regions, bypassing local KIBS.

This implies that acquisition of local manufacturing firms by externally owned multinationals could have a negative effect on the demand for local KIBS unless foreign multinationals are committed to developing local ties. It follows that KIBS in nonmetropolitan regions may face bleak prospects for development and expansion unless local control over the economy consequently results in increased demand for local KIBS (Coffey and McRae, 1989). The danger is that "in core city dominated economies such as England, the most high level expertise will be imported from elsewhere, for example, from large KIBS companies with headquarters in core regions" (Wood, 2010, 2). However, if co-location between KIBS and clients is important an array of KIBS functions can develop in de-industrialised regions, sparked by local demand and with a scope to develop global expertise. The above and related studies largely investigate relations between KIBS and their customers in terms of trading links. This is in line with the Industrial-complex model. The notion of space in such and related models is not necessarily urban but rather concerned with the minimisation of distance costs. These models are based on the analysis of firms' input-output requirements whereas they neglect firms' needs for longer term cooperation motivated by knowledge sharing and cooperation for innovation.

KIBS-Customers Co-location

A number of studies acknowledge that KIBS tend to locate close to their customers. Some of these studies combine agglomeration effects in KIBS' location decisions with the need for cooperation for innovation and knowledge transfer between KIBS and their customers or partners. As a methodological tool of investigation majority of these studies use either case studies of individual firms or surveys. For example, Koschatzky (1999) tested and confirmed his hypothesis that KIBS innovation activities also reflect their ability to interact with their partners and that these phenomena are not spatially neutral.

Koschatzky (1999) applied probit models to data for thirteen German regions and found that horizontal networks of service firms located in central regions are characterised by interregional cooperation which may help improve interregional innovation. Doloreux and Mattison (2007), for the Ottawa region, stressed the importance of local proximity since KIBS tend to collaborate more with local partners. In a similar manner, Muller and Zenker (2001) assert that..."*proximity does matter, since building common tacit knowledge implies close contacts, at least in the beginning*".

Koch and Stahlecker (2006) investigated the relationship between KIBS and their customers and suppliers in three German metropolitan regions (Bremen, Munich and Stuttgart). They showed that especially in the early stages of the development of newly founded KIBS, geographical proximity to their suppliers and clients seems to play a crucial role. Huggins (2006) study of the City of London legal cluster noted that geographic proximity provides the grounds for the innovation. This is because finance, banking and corporate clients are becoming increasingly sophisticated in their requirements which in turn requires law firms to become increasingly innovative in their solutions. Although technology may render remote communication viable, the majority of legal firms do not foresee this leading to any decline of face-to–face contact (Huggins, 2006). In this study, the importance of proximity is illustrated by one firm which relocated half of its team to an office location close to Lloyd's of London. The evidence above points to the importance of geographic proximity for KIBS relations, however, some studies emphasised that clustering in space promotes global rather than local access and attributes of regions.

Keeble and Nachum (2002) provided analysis of national and regional patterns of KIBS characteristics in the UK. Starting from the evidence of the geographic concentration (or clustering) of KIBS and the existence of "counterparts" (i.e. decentralised KIBS locations in small towns and rural regions of Southern Britain); they tried to answer the main question: Why do KIBS cluster? It appears from their analysis that KIBS operating in central London differ significantly from their decentralised counterparts (displaying a much higher level and intensity of global activity). Keeble and Nachum (2002) interpreted the clustering of KIBS as a consequence of the need for and benefits of proximity and accessibility to clients (in London as well as on a global scale). In a similar manner, Wood (2002) addressed the issue of the existence of specifically urban benefits by focusing on major consultancy firms in the UK. According to Wood (2002), KIBS (and particularly the large ones) gradually strengthen the "global" rather than the "local" attributes of cities.

If KIBS depend upon proximity and accessibility to their customers, as the above studies emphasise, it follows that the potential for KIBS decentralisation towards de-industrialised regions may be limited. Following this line of reasoning KIBS' role in regional economic development of de-industrialised regions is a rather constrained one. One possible exception may be KIBS that are closely linked with basic activities and other firms in particular locations such as manufacturing and extraction industries such as oil and gas. They may be detrimental in providing good functioning of the industries they support and may subsequently develop global expertise.

2.3.4 KIBS Structural Role

The contribution of any sector to the economic success of their respective region has often been analysed based on their contribution to the economic base or in other words their ability to export their goods or services outside their region. However, economic base model has been criticised on the grounds that economic flows are much more complicated and that in contemporary economies most sectors are interlinked, not to mention the importance of non-monetary flows (Illeris, 2009, 5). Moreover, as noted above KIBS contribution to wider regional success consists not only of their exporting ability but of the support and productivity enhancing role they play in relation to local customers they serve. Hence, in order to assess this contribution we need to establish what markets KIBS SMEs serve.

Further, innovative KIBS help build up of the local pool of knowledge. This is because KIBS act as knowledge facilitators by forming various linkages with actors within and outside the region where they locate. This results in positive externalities which may enhance competition and reduce regional disparities (Malecki, 1981). And whereas KIBS contribution to regional employment will be assessed in Chapter 3, the role which KIBS play as innovators in their own right and facilitators of knowledge in regional systems of innovation is examined in Chapter 6. Chapter 5 concerns the role KIBS play as engines of economic success by establishing the extent of their own extra regional exports and their support to local and regional customers.

Two different conceptualisations with regards to the role of services and geographic proximity can be identified in the literature (Doloreux and Shearmur, 2013). On the one hand, there is local innovation systems approach (Cooke and Leydesdorff, 2006) which states that the presence of local services is important. Given that accessible KIBS are rare in peripheral areas, we can expect less service utilisation and consequently less innovation. On the other hand, the proximity approach as advocated conceptually by Boschma (2005) and empirically by Shearmur (2011) postulates that innovation systems are not territorialised. This implies that there is no *a priory* reason to believe that businesses in peripheral areas will be disadvantaged or less innovative compared to those in major metropolitan areas because they can access KIBS from distant locations.

However, Illeris (1994) shows that it is mainly large corporations which make use of distant even global networks of service providers whereas small firms primarily use local or regional KIBS. Furthermore, it is acknowledged in this research that inter-sectoral relationships, which are important for regional development, consist not only of money flows but also of flows of knowledge between firms and other actors in the innovation system. It is also acknowledged that some dependencies are more important than others. In other words, analysis of the survey data shows which dependencies are most important for KIBS in de-industrialised regions, be it local manufacturing, households or perhaps other, more distant services.

KIBS dependence on local conditions and in particular local customers is noted in Chapter 5. However, it is important to distinguish those KIBS which are dependent on proximity to their customers in a similar manner as consumer services are dependent upon proximity to customers or indeed those KIBS (for example accountants, lawyers and banks) who provide customised services and serve predominantly local clientele. Other KIBS are able to sell their services to customers over large geographic locations including internationally.

Some of KIBS services are so specialised indeed and fall into “born global” category (Toivonen, 2004) selling their services all over the world. The role of ICT and other technologies may reinforce this process of specialisation by enabling KIBS to develop their services in one place and sell them elsewhere. Evidence suggests that distance to customers does play a role but that it has been influenced by new technologies such as telecommunications, air transport, road transport, fast trains etc. These developments are particularly relevant for globalised KIBS, located in large metropolitan areas. However, the local specialisation of KIBS is expected to be determined by the role of intermediate demand and in particular by the structure of intermediate linkages between KIBS and their manufacturing and service users and the region specific sectoral structure (Meliciani and Savona, 2014).

Thus, the argument adopted in this thesis is that *local* dimension of KIBS in de-industrialised regions goes beyond agglomeration effects and concentration in large urban areas or sole cost reducing input-output considerations. In other words, the focus on intermediate linkages for KIBS is important from the perspective of knowledge sharing and knowledge accumulation and facilitation between KIBS and their customers. This is because KIBS facilitate innovation and tradability in their customers and this is how they contribute to local economic development.

Therefore the first research sub-question this thesis aims to address is: **To what extent do KIBS in de-industrialised regions depend on the industrial structure of their regions and to what extent are they tradable across space**? This is the first theme within the main research question which will be addressed in Chapter 5. To answer this question the analysis aims to investigate KIBS' customer profiles as well as to determine whether urban, older and larger KIBS are more likely to export outside their regions. Analysis also aims to differentiate further between KIBS sub-sectors.

The importance (or otherwise) of KIBS-clients co-location will depend on how easily can clients access KIBS knowledge and expertise across distance. It can be concluded from the proceeding literature review that agglomeration literature pays insufficient attention to the role of intermediate demand or the role of cooperation for knowledge sharing and innovation. However, studies which emphasise the importance of knowledge sharing in KIBS tend to focus on dyadic relationship between KIBS and clients and pay little attention to how demand for KIBS may differ in de-industrialised regions as well as how KIBS integrate with other actors and institutions across space. The next section discusses the role of KIBS within systems of innovation framework which does emphasise innovation and knowledge sharing linkages between firms and institutions across space.

2.4 KIBS in National and Regional Systems of Innovation

2.4.1 KIBS in National Systems of Innovation

A key feature of innovation system approaches is an understanding of innovation as an interactive and dynamic process that relies on learning and networking (Uyarra, 2011). Systems of Innovation are frameworks for understanding learning and innovation which have become popular, particularly among policy makers and innovation researchers, first in Europe and later elsewhere in the world. According to the innovation system theory innovation and technology development do not happen in isolation, within enterprises, but as a result of a complex set of relationships among actors in the system, which includes enterprises, universities, research institutes and other actors.

In 1985 Lundvall developed a “System of Innovation” concept but the idea goes back to the Friedrich List´s conception of “The National System of Political Economy” (1841) (Freeman, 1995). Christopher Freeman first introduced the term "National Innovation System" in his 1988 study of the success of the Japanese economy. The concept was later applied to regions (see for example Cooke, 1998) and sectors (see for example Malerba, 2002).

And while Nelson (1993) and Freeman (1995) focus on infrastructural and institutional aspects of innovation systems (e.g. R&D organisations, universities), Lundvall (1998) emphasises the importance of communication and learning for innovations to occur. From this point of view, innovation dynamics are not only determined by the existing knowledge stock, but mainly by the effectiveness and the efficiency of learning processes within innovation systems (Lundvall, 1992). System of innovation is both a social system and is spatially defined, *“including all parts and aspects of the economic structure and the institutional set-up affecting learning as well as searching and exploring – the productive system, the* *marketing system and the system of finance present themselves as sub-system in which learning takes place"* (Lundvall 1992,12).

Systems of innovation studies aim to establish whether existing organisations and institutions promote or hinder innovation and how should institutions and organisations be changed and engineered to induce innovation (Edquist et al., 2002) This dynamic perspective on institutions and organisations and relationships is crucial in the systems of innovation approach (Edquist et al., 2002). This is in stark contrast with a static neoclassical model which only recognises the possibility of a market failure in relation to innovation.

The neoclassical model allows for the possibility of underinvestment in R&D due to high risk and uncertainty associated with the innovation activity; existence of externalities or in other words possible inability to appropriate full benefits of knowledge (which may become available to competitors); and the presence of indivisibility such as necessary minimum level required to start R&D. Thus, appropriate policies to mitigate the above shortcomings may include: government investment in R&D, R&D tax credits to companies, patent laws and regulations, encouragement of discoveries etc.

Contrary to this view, the innovation systems approach acknowledges the possibility of not just market failures but also system failures (Todtling and Trippl, 2005). Moreover, since most innovation in the developed world and the UK in particular occurs outside of the manufacturing sector (given the importance and scale of the service industry in the UK plus the common understanding that services do not invest excessively in R&D and do not extensively engage in patenting), it follows that sole emphasis on R&D policies and intellectual property protection may not be sufficient to promote innovation in services. Moreover, KIBS play systemic role as knowledge bridging institutions.

KIBS are perceived as important bridging institutions in the innovation systems linking knowledge producers and knowledge users (den Hertog and Bilderbeek, 2000). KIBS role can be either to translate users' problems into solutions in terms of knowledge and technology, to match users with the appropriate technology available, or to increase awareness of the benefits of the use of certain technologies (den Hertog and Bilderbeek, 2000, 227). "*This intermediary process, often referred to as technology transfer, plays a key role in the distribution of power within a National Innovation System"* (den Hertog and Bilderbeek, 2000, 227). Moreover, in their earlier study den Hertog and Bilderbeek (1997) suggested that KIBS could gradually develop into second knowledge infrastructure, complementing but partially taking over the intermediary role played by first level knowledge infrastructure institutions such as universities, public institutions, research and technology organisations etc.

KIBS play important role in regional, national and international systems of innovation as sources, carriers and facilitators of knowledge (den Hertog and Bilderbeek, 2000; Muller and Zenker, 2001). KIBS are embedded in innovation systems where they engage in formal and informal collaboration not only with customers but also suppliers, government agencies, universities, business networks, competitors, informal contacts, alliances etc. They source knowledge located outside the boundaries of a firm, process this knowledge in combination with existing internal knowledge, often in collaboration with clients, and further reinforce the process of knowledge facilitation.

However, many studies mostly drawing insights from the Community Innovation Surveys (CIS)[11] often find services, including KIBS, not to be extensively linked to wider innovation systems and institutions (Miles, 2005). Further, Djellal and Gallouj (2001) argue that the role of public organisations and universities as sources of innovation in services is negligible. Contrary to this, Trippl and Todtling (2010) conducted a specialist survey and found that firms in Vienna software cluster interact

[11]The Community Innovation Statistics/CIS are the main data source for measuring innovation in Europe. Aggregated data are disseminated on the Eurostat webpage under CIS data. The tables cover the basic information of the enterprise, product and process innovation, innovation activity and expenditure, effects of innovation, innovation co-operation, public finding of innovation, source of information for innovation patents, etc. The Community Innovation Statistics (CIS) are produced in 27 Member States of the European Union, 3 countries of the European Free Trade Association (EFTA) and in EU candidate countries based on the Commission Regulation No 1450/2004. The data is collected on a four-yearly basis. The first CIS (CIS 1) was a pilot exercise, held in 1993 while the second survey (CIS 2) was carried out in 1997/1998, except for Greece and Ireland where it was launched in 1999. The third survey (CIS 3) was implemented based on the reference years 2000/2001. Subsequent surveys are carried out on a regular basis, usually every four years.

with wide variety of partners such as customers, competitors, universities and suppliers.

Tether (2001) identified that the most important external sources for the UK KIBS were suppliers and customers. He further distinguished three groups of sources (using factor analysis): competitors (more common amongst financial services and wholesalers and less widespread amongst computer and technical services); sources such professional conferences, meetings and journals, computer networks (common amongst technical services, uncommon amongst computer services) and universities, research institutes and patens (common amongst technical and computer services).

Tether's (2001) analysis of the CIS-2 survey for the EU confirmed the importance of KIBS-client interaction. Findings from this study showed that first, technology oriented KIBS (technical and computer services followed by financial services) are more innovative than other services. Second, information within the firm was the most cited source for innovation. Third, amongst the external sources those most frequently identified in terms of relevance and importance were clients. In Tether's analysis (2001), suppliers and competitors were also widely seen as relevant sources of information for innovation and a number of KIBS firms identified sources such as fairs and exhibitions and professional meetings and journals as relevant for innovation. Similarly, Leiponen (2005) found that the most innovative KIBS firms engage with external sources, particularly customers and suppliers.

KIBS innovation researchers have, for a long time, been preoccupied with KIBS as generators of knowledge and innovation in their own right and as facilitators of innovation in their clients. In this line of research, theoretical frameworks often employed by KIBS innovation scholars, but largely ignored by KIBS geographers, are national, regional and sectoral systems of innovation. However, more evidence is needed regarding the extent to which KIBS are embedded in systems of innovation. Future empirical evidence from different countries and regions should focus on identifying main patterns of KIBS' interaction with various actors in innovation systems. This topic, with regards KIBS based in de-industrialised regions in the UK, is investigated in Chapter 6.

It should be noted that systems of innovation framework has been criticised on several grounds. It was argued that it became a loose framework for empirical research failing to specify what exactly should be included in the system of innovation (Uyarra, 2011). Second, the framework is biased towards science based innovations and towards formal knowledge at the expense of contextual and informal knowledge. Systems are considered as a tool, a target, and often an outcome of policies, whose performance can be improved or fine-tuned through the right policy levers. Similarly, performance comparisons or benchmarking across systems have taken centre stage, while insufficient attention has been placed on systemic dissimilarities and context, country and history-specific structures and elements of particular systems (Uyarra, 2011).

Further, regional systems of innovation were largely interpreted as smaller-scale versions of national system but such approach is not sufficient (Iammarino, 2005). This is because it tells us little about the nature of institutional change and about the dynamics of system evolution (Iammarino, 2005). Nevertheless, given the importance of close KIBS-customer interaction (see section 2.3.3), as well as different pattern of KIBS concentration in different regions (see chapter 3), regional system of innovation may provide a more useful framework for investigating the role of KIBS in economic development.

2.4.2 KIBS in Regional Systems of Innovation (RSI)

It is generally acknowledged in the literature that the spatial scale of services innovation is more likely to be regional rather than national or global and this possibly reinforces the importance of local embeddedness and positive effects of clustering or agglomeration effects (Love et al., 2010). KIBS may be important bridges in the process of interactive innovation and adaptation in de-industrialised regions given a particular relevance of user-producer interaction in KIBS and their clients and the fact that KIBS are involved in interactive learning processes with customers but also other agents/organisations within the local innovation system (Strambach, 1998; den Hertog, 2000; Thomi and Bohn, 2003).

Regional systems may be distinguished from national innovation systems by observed differences across regions in industrial structure, R&D and technology provision, policy initiatives, business service provision, governance structures and the institutional framework and the nature and extent of interrelationships between key players (Oughton et al., 2002). Similarly, knowledge transfer, learning, agglomeration economies and external economies are factors that operate differently and in some cases exclusively at the regional level (Oughton et al., 2002). Consequently, research about the territorial implications of innovation activities in the past increasingly followed the line which argues that sub-national systems or regional innovation are becoming more important for policy formulation and economic development (Braczyk et al., 1998; Cooke, 1998).

"*Proximity to key knowledge sources is one of the key reasons why a number of the most successful localities and regions throughout the world have become more competitive compared to those not adopting a networked approach*" (Huggins et al., 2009, 8).

It follows that only those firms and organisations located in geographic environment rich in relevant knowledge sources can benefit from it. Many of the existing studies on regional innovation systems do focus on high technology regions (see for example Saxenian, 1994; Lawton Smith, 2003). "*This is not surprising given that the evidence points to great advantages derived from locating within places characterised by the active transfer and diffusion of technological and managerial expertise*" (Huggins et al., 2009, 9). However, drawing policy prescriptions from successful regions neglects the same institutional, historical and industrial foundations which often differ across different types of regions. This contradicts RSI own conceptual foundations which are based on regional distinctiveness.

In uncompetitive regions, for example, the propensity of firms to engage in knowledge sourcing networks is often associated with the characteristics of individual entrepreneurs whose conduct is shaped by the underlying social and business culture prevailing in the region (Watts et al., 2006). In addition, de-industrialised regions may suffer from lock-in or path dependency, in other words a level of inertia among firms within the region that prevents changes from occurring (Martin and Sunley, 2006). Lock-in means that a particular technology or product is dominant (which is often the case in de-industrialised regions in relation to outdated industries and technologies), not because the inherent cost is low or performance is good, but because it enjoys the benefits of increasing returns to scale.

Further disadvantages may arise due to organisational thinness such as lack of organisations in the fields of research, education and/or technology transfer. In some de-industrialised regions overspecialisation in traditional industries may persist and/or inappropriate or missing interaction or links between different actors and organisations involved in the innovation process may persist causing lock-in and stagnation (Todtling and Trippl, 2005). Also, if external or international links are poorly developed the region may suffer from a limited access to international pools of resources and knowledge (Todtling and Trippl, 2005).

Huggins et al. (2009, 23) acknowledged that, "*by necessity, leading firms in regionally sparse knowledge environments may be required to make a number of non-local linkages*". The study of the relatively uncompetitive region of Yorkshire and Humberside finds that the most frequently utilised sources of knowledge for knowledge-based SMEs in the region are their customers and suppliers, who are located elsewhere (Huggins and Johnston, 2009). Love et al. (2010) found that a very small proportion of Northern Ireland service firms have either intra-regional or extra-regional linkages as part of their innovation activity. This study shows that intra-regional linkages contribute little while extra-regional linkages with customers have a significant and positive effect on KIBS innovation. However, Boschma (2005) noted that in any type of region intensive intraregional connectivity may potentially result in negative lock in, whereas external connectivity usually plays a positive role.

A number of conceptual problems arise in relation to the portrayal of regions in the RSI literature. One of them, as mentioned above, is a perceived neglect of external networks and institutions. This is because connected firms may not necessarily be co-located and the influence of non-physical proximities such as cognitive, organisational, social and institutional may be important (Boschma, 2005). A related problem, as noted by Iammarino (2005), is that RSI concept adopts top-down or macro-to-micro approach which pays insufficient attention to the actors and bottom-up relationships and the learning processes operation on a sub-national level.

Micro approaches are more agent-centred and concentrate on explaining entrepreneurial behaviour of innovative firms which results in knowledge creation and diffusion. The analysis of the openness of regional innovation systems thus requires a consideration of both the relevant networks for innovation and the institutional frameworks supporting these links (Uyarra, 2010). The related literature on clusters and networks, rather than focusing on regions and institutions, takes firms, industries and their linkages as primary object of analysis. This corresponds to the so called bottom-up approach as advocated by Iammarino (2005).

2.5 Clusters, Knowledge Spill-overs and Networks

2.5.1 Intra Regional and Localised Linkages

A central argument within the learning regions literature is that knowledge spills over more readily between neighbouring firms and research institutions such as universities than it does between distant actors. Asheim and Mariussen (2003) identified the scholarly stream of evolutionary economists and other social scientists who emerged during the 1990s and who produced a number of empirical and theoretical studies supporting geographical relatedness or face-to-face theories. In their proposed list Asheim and Mariussen (2003) included: Amin (1994); Asheim (1996, 2000); Cooke (1998, 2001); Gertler (2001); Lundvall (1992); Malmberg and Maskell (1997, 2002); Morgan (1997); Porter (1990, 1998); Scott (2000); Storper (1997) and several others.

Within the regional paradigm, Asheim and Mariussen (2003, 15) identified two main perspectives, one was “cluster approach”, and the other, “regional innovation systems (RIS) approach”. Much of this research which is related to the idea of localised nature of knowledge spill-overs was inspired by Piore and Sable's (1984) concept of flexible specialisation as explained by Asheim and Mariussen (2003). In the face of international competition and changing customer demands, the process of flexible specialisation is driven by the need for firms to be more flexible and more specialised in the ways in which they organise their production. "*The result is a networked form of production that leads to a reconnection of economic activities to local space because of the need for proximity between the numerous specialists involved in any given value chain*" (Simmie, 2005, 799).

Many research studies place emphasis on learning by interacting, concentrating at the same time on intra-regional relationships between firms and other economic actors. This is in contrast to RSI approach which largely focuses on institutions rather than firms and industries and relationships between them. These studies propose that learning is enhanced by regional clustering and geographical proximity. In this respect both traded and untraded interdependencies (Storper, 1997) are seen as pivotal to regional success. However, all these related concepts have been developed to capture the importance of geographic proximity and innovation. In studies on clusters as well as other extensive literature on industrial districts, innovative milieu, regional innovation systems and learning region, spatially bounded knowledge is perceived as the most important source.

Asheim and Isaksen (2002) argue that many studies on clusters often imply that knowledge from sources external to a cluster is of inferior importance for firms' competitiveness. This literature, in line with RSI approach, puts emphasis on the importance of the region as a scale of economic organisation coupled with associated policy developments often draws evidence from exemplar regions such as Silicon Valley, Boston, London, Oxford and Grenoble. These regions have a high concentration of service related industries and high technology sectors such as biotech and high tech electronics (see for example Lawton Smith, 2003).

A variety of explanations have been offered with regards to the positive role of clustering in space. Some of these explanations relate to the tacitness of some types of knowledge, making its transfer across distances difficult. Others refer to the nature of personal relations and trust, lower communication costs and enhanced quality of interaction through face-to-face contact (see for example Gordon and McCann, 2005). Other literature, however, questions the supremacy of geographical proximity and the region.

Spill-overs

Related stream of literature, often referred to as geography of innovation, embraces a group of mostly empirical works which aim to measure knowledge spill-overs. In doing so, data on R&D and patents are used most frequently (see for example Jaffe et al., 1993; Acs and Audretsch, 1998; Audretsch, 1998; Feldman, 2000). Jaffe (1986) found that significant proportion of knowledge which positively affects firms' research productivity stems from other firms. He also identified that benefits to firms' research efforts accrue from other, technically related firms. Later, Jaffe (1989) examined geographically mediated knowledge spill-overs and found that patents occur in those states where public and private knowledge generating inputs are the greatest. Feldman (1994) confirmed these results and found that regions with relatively greater number of knowledge generating inputs produce more innovation.

Jaffe at al. (1993) find evidence to support their claim that patents cite other patents originating in the same city more frequently and that citations are five to ten times more likely to come from the same city. Almeida and Kogut (1997) studied patent citations in the semiconductor industry. They find that that patent citations are highly localised. Jaffe and Trajtenberg (1996) find that electronics, optics and nuclear technology exhibit high immediate citations but given the high rate of obsolescence of these innovations these industries experience fast reduction in citations with time. All of these studies confirm that knowledge spill-overs tend to be geographically bounded and that knowledge tends to spill over shorter geographic distances.

Clusters

Porter (1990, 1998) elaborated upon the demand and supply side effects of agglomeration economies and conceptualised clusters in a particular way. He broadened the supply-side effects to include the role of education and labour skills, land and site availability and the supply of innovation, new knowledge and finance. Many of these factors are strongly influenced by public policy decisions. Supply side effects result from institutional structures which are also influenced by government. These include: competition law, regulatory structures and compliance frameworks. Porter argued that clusters help an area to compete and hence to maintain or increase its rate of economic growth. Porter's cluster approach has had profound policy implications but it failed to recognise that benefits to clustering and characteristics of clusters may differ between industries and different locations. Also, Porter's cluster approach doesn't provide insights into the nature of relationships between firms, institutions and individuals within the cluster which in turn may influence the formation and functioning of clusters.

An alternative way of conceptualising firms' clustering in space has been proposed by Iammarino and McCann (2006), following from and extending upon Gordon and McCann (2005). Iammarino and McCann (2006) identified three models of agglomerations/clusters. In their taxonomy they address the problem of "one cluster fits all" and take account of different types of clusters. In the first model of pure agglomeration there is no loyalty between firms, nor are there any particular long-term relations. This type of clustering only exists within individual cities. Second type, industrial complex is characterised by long-term stable and predictable relations between firms within the cluster that involves frequent transactions. This type is most commonly observed in industries such as steel and chemicals. The notion of space is local but not necessarily urban and it may extend regional and country boundaries and is dependent on transportation costs. These two types of clusters form due to benefits associated with agglomeration economies.

However, agglomeration factors alone may not be sufficient to explain the tendency of firms to cluster in space. Agglomeration theories explain the location of business concentrations as a result of the advantages gained from reduced transaction and transport costs and the increased potential for face-to-face contact. These benefits derive from reduced search, bargaining, monitoring and transaction-specific costs between firms. The third type of cluster as identified by Iammarino and McCann extends beyond the pure agglomeration effects and is associated with social network model (Granovetter, 1973). In this type of cluster mutual trust relations between key decision makers in different organisations are important. These trust relations come in various forms such as joint lobbying, joint ventures, informal alliances etc. The notion of spatial proximity is necessary but not sufficient to acquire access to the network. According to Iammarino and McCann (2006) all spatial clusters or industrial concentrations will contain characteristics of one or more of those ideal types, although one type may be dominant in each cluster.

Iammarino and McCann's typology draws from concepts such as industrial districts (Becattini, 1987), clusters (Porter, 1990), innovative milieu (Camagni, 1991), technology districts (Storper, 1992), regional innovation systems (Cooke, 2001), learning regions (Asheim, 1996) and social networks (Granovetter, 1973). In their third type of clustering, Iammarino and McCann (2006) build upon Marshall's idea of "knowledge in the air" which implies that knowledge flows are drivers of innovation and growth and that they take place more easily over shorter geographic distances. The above clustering typology (similarly to RSI approach) has largely been used to draw conclusions from exemplar regions. It is only rarely acknowledged that places may vary in the amount and quality of knowledge sources so that least competitive and most peripheral regions may be less endowed with high quality knowledge.

In response to this shortcoming, Iammarino and McCann (2006) and Giuliani (2007) question whether clustering is necessarily associated with intense information and knowledge exchange and suggest that strategic, innovation related interactions may not require co-location. Empirical evidence related to firms in remote areas and small towns which often introduce significant innovations (see for example Freel, 2003; Lee and

Rodrigues-Pose, 2013) also challenges the importance of location and co-location.

As will be shown in Chapter 3 and in line with a number of previous empirical studies (see for example, Marshall, 1982; Howells and Green, 1986; Gillespie and Green, 1987; Chadwick et al., 2008) concentration of KIBS in large metropolitan areas has largely persisted over time in the UK but evidently in other countries as well, for example Canada (Shearmur and Doloreux, 2008). Thus, "*Most research, which identifies the importance of markets in KIBS location, is based on the workings of metropolitan economies*" (Glasmeier and Howland, 1993, 220). Also, KIBS geographers have so far been mostly concerned with the effect of agglomeration on KIBS location decisions and paid little attention to how are KIBS interconnected with other players in the innovation system. For this type of analysis the social network model, which transcends location boundaries, may be particularly useful.

There is currently a considerable debate over the nature and existence of a link between firm-level innovation and space. Research traditions such as the above mentioned: RIS, clusters, learning regions and geography of innovation show that in particular cases local institutional or cultural factors can be conducive to innovation. Other approaches have shown that the presence of knowledge workers, of high levels of knowledge spill-overs, or of competition and cooperation between firms can lead to innovation. What these approaches have in common is the way they conceptualise the region i.e. as geographic space which has certain attributes that it does not share with others (Shearmur, 2008). Those attributes, whatever their nature, are what leads establishments in certain regions to innovate more than others.

A number of researchers have more recently begun to suggest an alternative way of conceptualising space. For example McCann (2007) and Andersson and Karlsson (2004) characterised space by accessibility and potential. Each point in space provides establishments with a series of opportunities. Locations that provide the best combination of opportunities (whether these opportunities are in the establishment's locality or not) will tend to encourage innovation more than others (Shearmur, 2008). These opportunities may well be opportunities of access to social networks, research institutions, competitors, collaborators, workforce and infrastructure (Shearmur, 2008).

This novel perspective which emphasises relational propinquity is in stark contrast to the above discussed regionalist and geography of innovation perspectives (Shearmur, 2008). In relational perspective location is understood as situated distanced networks (Shearmur, 2008). It is argued that relational or organisational propinquity is more important than geographical proximity in transfer of knowledge (Amin and Thrift, 2002). The focus is on the firm as the locus of knowledge rather than the region. The analytical focus is on space that is defined by the firms' relations (Shearmur, 2008). This position is in line with the growing empirical evidence which shows that establishments increasingly draw knowledge from the environment beyond their region. This is in line with social network model.

2.5.2 Internationalisation of KIBS and Extra-regional Linkages

The social-network model was developed within the sociological literature (Granovetter, 1985). It is argued that social networks of certain strong interpersonal relations depend crucially on interpersonal trust and the informality of these relationships is viewed as potential strength rather than a weakness in incomplete contracts (Gordon and McCann, 2000). These features imply that price signals are not sufficient to ensure implementation of a particular project or activity. This reasoning is in line with industrial clusters where both clusters and social networks approach differ from the agglomeration model in that there is a belief that clusters and networks reflect not simply economic responses but also embeddedness and social integration.

However, in contrast to clusters, there is nothing inherently spatial about the social-network model even though many of the social interactions are made possible by geographic proximity. It has been argued that inter-firm interaction is not necessary local and that the effect of networks (perceived as a-spatial concept) seems underestimated (Boschma and Ter Wal, 2007; Ter Wal and Boschma, 2011). This argument acknowledges that firms also need extra-regional knowledge to avoid lock-in effects associated with outdated technology and decreasing market opportunities (Bathelt et al*.,* 2004; Gertler and Wolfe, 2006).

A number of studies (see for example Malmberg and Maskell, 2002; Oinas and Malecki, 2002; Bathelt et al., 2004) therefore emphasize that both local and global knowledge is important. Overall, firms investing more in development of their inter-firm and other external knowledge networks enjoy higher levels of innovation (Huggins and Johnston, 2010). Transfer of knowledge and ideas from global networks may mitigate the possible stagnation and lock-in effects of the regional knowledge base and may be particularly beneficial in de-industrialised regions. This may be enabled by advancements in information technology and falling costs of transport and communication. The role of KIBS in facilitating both internal and external networks for such regions may therefore be significant.

Some, more recent empirical studies (see for example Morrison, 2008; Graf, 2011) find that the role of "gatekeepers", who represent important firms or institutions in clusters, is to draw on local as well as external knowledge. In their study of the Chilean wine cluster Giuliani and Bell (2005) show that knowledge diffusion takes place mainly in a core group of firms with absorptive capacity, whereas other firms with inferior absorptive capacity remain isolated from the knowledge network[12].

In summary, the conceptual debate within the geography of knowledge interactions literature is moving towards an emerging consensus which postulates that innovation capacity depends on both local and global knowledge flows. For example, Bathelt et al. (2004) provided a concept of “local buzz and global pipelines” to emphasise the importance of both local and global sources. Some early studies (see for example Storper, 1997) demonstrated that traded relationships are usually conducted at a higher spatial level, reaching beyond the region, where trade links are considered as the most important mechanisms of inter-regional and international knowledge transfer (see for example Feldman, 2000). Also, Archibugi and Iammarino (1999) noted that networks are often

[12] For a comprehensive review of the empirical studies on innovation networks see Boschma and Ter Wal (2009).

conducted at an international or even global scale. More recently, Davenport (2005) showed that New Zeland's knowledge intensive SMEs show lack of geographic proximity in their knowledge acquisition activities.

Very few KIBS studies address the issue of the geography of knowledge sourcing and innovation in KIBS. Amongst these few, Aslesen and Isaksen (2007) proposed that KIBS' traded relationships, in the form of market transactions, are less likely to be geographically bounded whereas untraded relations, in the form of knowledge networks, are more likely to be geographically sticky. Doloreux and Mattson (2007) provided evidence from Canada which indicates that innovative cooperation between knowledge intensive industries and external actors takes place at the local, regional, national and international level noting, however, that local sources are still important.

Empirical evidence regarding the importance of global traded relations for UK located KIBS comes mostly from the metropolitan regions and previous studies which investigated this issue in less developed regions, although indicative, are more than a decade old (see for example O'Farrell et al., 1996). Hence, this research aims to fill this gap in the literature by providing new empirical evidence from de-industrialised regions. Moreover, even though international traded relationships seem to be important for KIBS there is little agreement in empirical studies regarding the relationship between exporting (international traded relationships), R&D and innovation, which appear to act in a complex relationship to each other (Harris and Moffat, 2011).[13]

As discussed in the previous section, empirical evidence suggests that face-to-face contact is no longer exclusive way of tacit knowledge transfer between parties and that local and global interactions may complement each other. However, it has been argued that successful cross-border transfer of knowledge requires the movement of people and the development of relationship of trust and mutual understanding between

[13] It seems that undertaking R&D and/or innovating may or may not impact on the firm's decision to export , and in turn to be influenced by the experience of exporting (i.e., through a "learning-by exporting" effect) (Harris and Moffat, 2011). It is, however, outside the scope of this research to dismantle the complex relationship between R&D, innovation and exporting.

the producer and the client (Roberts, 2000). It follows that neo-regionalist approach (which promotes the benefits of clustering and local knowledge sharing) should be empirically tested against the alternative spatial analytical approach with reference to KIBS knowledge sourcing practices and their networks.

This is particularly important for small firms as to compete successfully with large ones small firms may need to develop external networks to access resources which they do not possess internally (Kingsley and Malecki, 2004). Since majority of KIBS are SMEs and this thesis is concerned with KIBS SMEs, the issue of external networks and external knowledge sourcing warrant particular attention. An important requirement for knowledge to be transformed into externality is the capacity of potential users to understand and incorporate this knowledge, which in turn depends on their absorptive capacity. According to this approach, knowledge is not a good that anyone can get easily.

2.5.3 The Role of Absorptive Capacity

Closely related to innovation and learning is the idea of absorptive capacity (Cohen and Levinthal, 1989; Cohen and Levinthal, 1990; Zahra and George, 2002). Absorptive capacity is referred to as the ability of a firm to identify, assimilate and exploit knowledge from external resources (Cohen and Levinthal, 1989). Zahra and George (2000) elaborated on the concept further proposing that the absorptive capacity involves the abilities to acquire, assimilate, convert, and exploit knowledge, highlighting value creation as the dependent variable or the outcome of such capacity. They went on to suggest that absorptive capacity has potential and realized states. The absorptive capacity is mediated by the wider environment in which a firm competes and operates.

The role of place as the wider innovation environment has triggered a greater interest in the concept of absorptive capacity of places. Interest in inter-territorial learning has increased too (Hassink and Lagendijk, 2001). This has been particularly important for the study of learning and knowledge transfer through MNEs and cross national firm alliances. Indeed today international alliances are largely perceived as main mediums for knowledge transfer and learning between territories and countries (Koza and Levin, 1998; Lane et al., 2001), less is known about inter-territorial learning in SMEs.

The concept of absorptive capacity is important as it has been widely acknowledged that innovations can happen outside the boundaries of any given place, be it a firm, a university, a cluster, a city, a region or a nation and this has profound implications for policy making. Absorptive capacity has often been associated with the intensity of research and development (R&D). Some studies find that the role of R&D is negligible in KIBS (for example Tether, 2004). However, this may not apply for technological KIBS which are usually perceived as relatively R&D intensive (Howells, 2000; Hipp et al., 2000). Also, majority of KIBS are SMEs who may not possess the necessary resources to incorporate R&D departments within the firm boundaries. As a result they may be disadvantaged in their ability to absorb external knowledge. The role of absorptive capacity and internal knowledge (as proxied by investment in R&D by KIBS SMEs) is investigated in Chapter 6.

2.5.4 KIBS Systemic Role

KIBS literature indicates that KIBS SMEs have an important role to play in the innovation systems of countries and regions. This is due to their own innovativeness but also due to their role as co-producers of knowledge with their clients. This thesis aims to investigate how KIBS facilitate learning and knowledge transfer in international, national as well as regional systems not only in relation to clients but also other factors such as; alliances, patents, formal R&D collaboration, informal networks, clusters, universities, business and industrial associations, research institutes, supply chain networks, competitors and informal networks.

The particular emphasis is on de-industrialised regions because they may be lacking in some of the above mentioned institutions and may suffer from organizational thinness and/or lock-in effect as well as poor quality of knowledge. The ability of these KIBS to absorb external knowledge will also be evaluated. The role and impact of R&D/absorptive

capacity as well as external sources of knowledge will be evaluated in connection to innovation performance of KIBS SMEs in Chapter 6.

Moreover, what the literature on KIBS and innovation lacks is clear emphasis on the geography of linkages between KIBS and other factors in innovation systems and how these relationships affect innovation. One way to overcome these shortcomings is to build a model of KIBS innovation while linking ideas from the literature on networks. Such model would test to what extent internal and external sources of knowledge impact upon technology and professional KIBS innovativeness.

Muller and Doloreux (2007) emphasised that one of the main challenges for future KIBS research is to sort out more systematically the relationship between the roles and functions of KIBS in creating and diffusing knowledge and fostering regions as innovation systems and to show how can KIBS serve as drivers of knowledge dynamics on firm, sector and the territorial level. More empirical evidence is needed to help us understand the spatial variation of knowledge dynamics in KIBS in different geographical (regional) contexts. Hence, it is important to establish what type of proximity and interconnectedness matters for KIBS in de-industrialised regions.

It follows from the above discussion that much literature on KIBS concentrates on the relation between KIBS and customers and the importance of geographic proximity in these links (see for example, Koschatzky, 1999; Muller and Zenker, 2001; Keeble and Nachum, 2002; Koch and Stahlecker, 2006; Jacobs et al., 2011). This territorial innovation literature which takes into consideration geographical characteristics of inter-organisational ties shows that local links may enhance the innovativeness of firms whereas in more peripheral regions extra-regional ties may be of particular significance for innovation.

Further, many studies, directed at both KIBS and territorial innovation focus on *dyadic* relationships between a focal actor and for example, a single supplier or university and largely ignore the diversity of these links (Knoben and Oerlemans, 2012, 1006). Often evidence is drawn from more successful regions whereas less competitive regions are often neglected. KIBS innovation studies do pay attention to the diversity of links important for innovation but largely ignore the geographic context under which KIBS operate.

In summary, empirical research on KIBS innovation which takes into account the diversity of types of knowledge links would benefit from more emphasis on the level of localization of these links. At the same time, territorial innovation literature and KIBS location literature would benefit from research that takes into account diversity of the types of knowledge and the level of localisation of interactions which are important for KIBS. Both lines of literature would benefit further from empirical evidence drawn from less successful regions. In this context, this study emphasises the importance of both the geographical variety and diversity of KIBS inter-organisational networks for innovation in de-industrialised regions.

Following in the above reasoning the second research question this thesis aims to address is: **What are the determinants of KIBS innovativeness?** This is a second theme within the main research question which will be addressed in Chapter 6 by investigating which external sources of knowledge contribute most to KIBS innovativeness and over which geographies do these sources function.

Also, what is the role of absorptive capacity, as proxied by firms' investment in R&D, in facilitating external knowledge absorption? This sub-question is important because KIBS not only act as facilitators and generators of knowledge in their clients but also as drivers of territorial knowledge transfer and innovation in their respective regions. KIBS fulfil this role through their interaction with various business and trade organisations, suppliers, universities, informal contacts etc. The underlying assumption is that more innovative KIBS will drive competitiveness of their respective regions. KIBS facilitate this role by promoting the success of their local customers as well as accumulating local pool knowledge with the potential to spill-over to other firms and actors in the regional innovation system. Thus, it is important to determine which factors drive KIBS own innovativeness.

2.6 KIBS in Sectoral Systems of Innovation

2.6.1 KIBS Innovation Studies

The debate within the KIBS innovation literature has been conveniently classified by Coombs and Miles (2000) into: assimilation, demarcation and synthesis approaches. The assimilation approach postulates that services innovation is similar to manufacturing innovation. This approach proposes only minor modifications to conventional surveys and other instruments as well as inclusion of services in the population of firms to be studied (Coombs and Miles, 2000). The demarcation approach, in contrast, assumes that innovation in services is fundamentally different from that in manufacturing. It has been emphasised in the demarcation literature that a general theoretical framework applied in innovation studies and sources of data (for example CIS) were developed for the purposes of studying manufacturing sector exclusively (see for example Djellal and Gallouj, 2001) and as a result may not be suitable for studying innovation in services.

Demarcation scholars propose a separate, service-specific theory of innovation (see for example, Sundbo, 1998; den Hertog, 2000; Gallouj, 2000; Djellal and Gallouj, 2001). Some of these scholars have argued that innovation in services must be distinguished from the manufacturing innovation due to its intangible nature, inseparability and enhanced interactivity between a client and a firm. According to Coombs and Miles (2000) it is the two central features of services; intangibility and client-intensity that have influenced the development of the demarcation approach to service innovation.

In line with the demarcation approach a number of studies note the importance of close interaction between KIBS and customers**.** Hill (1997) emphasised that services and manufacturing innovation cannot be compared as service innovation arises as a consequence of the interaction with clients/service recipients. The synthesis approach transcends the sharp distinction between services and manufacturing innovation and, in contrast to demarcation approach, provides a middle ground between the two opposing approaches.

Over the last decade the economics business literature has been discussing competitive strategies and innovation in KIBS both theoretically and empirically (Corrocher et al., 2009, 175). In the empirical literature a particular line within industrial innovation tradition, largely drawing results from the CIS, investigates specific characteristics of KIBS innovativeness (see for example, Evangelista, 2000; Evangelista and Savona, 2003; Camacho and Rodriguez, 2005). This literature has provided some important insights into the nature of services innovation largely emphasising particular aspects which differentiate innovation in services to that in manufacturing.

Indeed, most research effort so far has been directed towards establishing what differentiates services from manufacturing and to a certain extent from other services. There has been very little effort aimed at identifying distinctive features of innovation within the KIBS sector. This is surprising given the complexities and diversity within KIBS sub-sectors. Tether (2003), Hollenstein (2003) and Freel (2006), however, have provided important pioneering research which demarcates different KIBS sub-sectors. It remains the case that empirical evidence is still sparse. This thesis aims to address this shortcoming in Chapter 7.

The exporting potential of KIBS and benefits which arise as a result of close interaction with customers within and beyond KIBS' immediate geographic locations have been noted in the geography literature. However, KIBS' major role and their contribution to regional economic development are perceived through their potential as knowledge facilitators within innovation systems. Evidence from the existing literature (see for example Strambach, 1998; den Hertog, 2000) shows that KIBS act primarily in regional to national contexts, however, due to their capabilities to extend beyond territorial and sectoral contexts and due to their own internationalisation (Roberts, 2000), KIBS are viewed as facilitators of knowledge dynamics at the territorial level (Strambach, 2008).

2.6.2 Conceptualising Knowledge in KIBS

An important ingredient in the systems of innovation discourse is knowledge and the mechanism by which it is generated and transferred through the system. To be spread to the whole economy, knowledge diffusion requires good channels of communication among agents and that once a specific knowledge is generated it can be passed without interruptions. The concept of knowledge base is related to the characteristics of the knowledge used in innovation. Various types of knowledge based taxonomies have been identified in the literature, for example universal versus specific, public versus private, and articulated versus tacit.

Generally, universal knowledge has a large applicable understanding. This knowledge is based on principles that are well known and pervasive while specific knowledge is particular to certain activities. Moreover, there is that knowledge that is public in the sense that it is available in scientific and technical publications as opposed to knowledge that is private and protected by laws (patents). In the case of public or codified knowledge it is necessary that the access to it is equally distributed over sectors and regions, which implies the existence of unlimited access. Finally, some knowledge is well articulated and for the most part written down in manuals or books. In contrast, there is that kind of knowledge that is tacit as it comes from an inarticulate experience and practice.

The concept of tacit knowledge has been synthesized by Polanyi (1958, 1967) in the following statement: "*We can know more than we can tell*" (1967, 4). In other words, "*perception is determined in terms of the way it is integrated into the overall pattern*" (Nonaka and Takeuchi, 1999, 216). Polanyi argued that knowledge acquisition is "*the outcome of an active shaping of experience performed in the pursuit of knowledge"* (Polanyi 1967, 6). Polanyi stressed the importance of experience, self-involvement and commitment to the understanding of tacit knowledge when he identified tacit knowing as indwelling. This idea has been explained by Nonaka and Takeuchi:

> "*To know something is to create its image or pattern by tacitly integrating particulars. In order to understand the pattern as a meaningful whole, it is*

necessary to integrate one's body with the particulars. Thus, indwelling breaks the traditional dichotomies between mind and body, reason and emotion, subject and object, and knower and known. Therefore, scientific objectivity is not a sole source of knowledge. Much of our knowledge is the fruit of our own purposeful endeavours in dealing with the world. "(Nonaka and Takeuchi, 1995, 60).

And while explicit knowledge can be expressed in a systematic and formal way in the form of hard data, scientific formulae or codified procedures, tacit knowledge, as Polanyi pointed out, is highly personal and hard to formalise. In this case, proximity or face-to-face contact is a necessary condition for its diffusion. This is in contrast to the neo-classical view, which assumes that knowledge is a "public good" (and, hence, non-excludable and non-rivalrous), that it can flow freely without any costs between individuals or firms. The discussion above indicates that the diffusion of knowledge externality is strongly influenced by the quantity and the quality of channels of communication of scientific knowledge and by the degree of proximity between the "producers" and the "users" of this knowledge, which is also in stark contrast to the neo-classical view.

A number of studies address the issue of knowledge and its relevance for KIBS, acknowledging that KIBS are not just providers of information to their clients but sources of knowledge, expertise and problem solvers (Antonelli, 1999; Windrum and Tomlinson, 1999; Larsen, 2001; Muller and Zenker, 2001; Bettencourt et al., 2002). The emphasis is on tacit knowledge due to simultaneity of production and consumption of services provided by KIBS and intangible nature of this knowledge. However, above mentioned studies stop short of providing classification of the types of knowledge utilised by different KIBS sub-sectors. Few studies which aim to do this look at KIBS from an industry viewpoint within the sectoral systems of innovation framework as originally proposed by Franco Malerba (see for example Malerba, 2002; Malerba 2005).

Strambach (2008) emphasised that, compared to manufacturing, approaching KIBS from an "industry" viewpoint is not common. This is because industries are characterised by the division of labour and use of particular production methods, neither of which are very pronounced in

KIBS (Strambach, 2008). Related to this is the lack of research which provides systematic analysis of specific knowledge bases and their influence on knowledge processes in KIBS (Strambach, 2008).

One of the first studies which positioned services within a sectoral systems tradition has been conducted by Pavitt (1984). Pavitt (1984) argued that two types of knowledge exist between (i) supplier-dominated, production-intensive and (ii) science-based industries namely; “analytical” (dominant in science based industries) and “synthetic” (dominant in services). However, Pavitt (1984) stopped short of providing any further classification of different service groups and placed all services under the “supplier-dominated” category. Later work attempts to address this shortcoming and a number of studies provide more systematic classification of services and KIBS in particular with reference to their respective sectoral characteristics (see for example Soete and Miozzo, 2001; Consoli and Elche-Hortelano, 2010; Tether et al., 2012; Pina and Tether, 2015).

2.5.5 KIBS sub-sectors as facilitators of knowledge across space

Strambach (2008) referred to Asheim and Getlers’ (2005) taxonomy of knowledge which distinguishes between; analytical (formally organised), synthetic (tacit knowledge) and symbolic knowledge (based on ideas) and applied it to KIBS. Strambach (2008) argued that analytical knowledge which tends to be formally organised and the output tends to be documented in reports, electronic files or patents may be applicable only to R&D KIBS. Another more dominant branch of the KIBS sector T-KIBS (technology based KIBS, such as engineering and software) focus on synthetic knowledge (Strambach, 2008). This type of knowledge is more tacit due to its creation through the new combinations of existing knowledge and an interacting process aimed at solving users’ problems (Strambach, 2008). Third type of knowledge related to more creative subsectors such as advertising, publishing, architecture, music, fashion and theatre is symbolic knowledge which deals with ideas, symbols and socially constructed commodities (Strambach, 2008).

Den Hertog (2000) provided alternative KIBS knowledge taxonomy and noted several dimensions of explicit/codified as opposed to tact/non-codified knowledge. Those dimensions are; discrete/tangible versus process oriented/intangible knowledge resource flows, human embodied knowledge versus non-human knowledge resources (such as capital, written information- for example report, written plan, an electronic database etc.) and contractual versus non-contractual forms of knowledge. Todtling et al. (2006) in their study of innovative activities of Austrian firms provided empirical evidence showing that KIBS follow a pattern of industries with a synthetic knowledge base as they rely more on activities such as development, design and market introduction, focusing in their output more on modifications and technology adoption. Also, for KIBS the most important channels of knowledge exchange are the buying of equipment and software, fairs and informal contacts and the hiring of specialists.

The above mentioned studies are amongst the few which aim to systematically classify the types of knowledge utilised by KIBS. Moreover, we know very little about the geographic remit of different knowledge functions. This shortcoming is evident not only in KIBS literature but also in sectoral systems of innovation literature and evolutionary economics literature. It follows that there is a need to provide a more systematic analysis about the nature and types of knowledge utilised by KIBS sub-sectors and to establish at what spatial scales these operate. Hence, the third research sub-question the thesis aims to address is: **How do different KIBS sub-sectors differ in their role as facilitators of knowledge across space?** This is the third theme within the main research question which is addressed in Chapter 7. Chapter 7 classifies individual KIBS sub-sectors in relation to their innovation and differentiated knowledge bases into analytic, synthetic and symbolic. This approach places KIBS within the sectoral systems of innovation perspective and recognises sectoral diversity in KIBS.

2.7 Conclusion

Strong recent interest in spatial industrial clustering from a variety of disciplines with diverse analytical approaches has led to a certain level of confusion as authors adopt various concepts in a more or less inter-changeable manner. The argument in this thesis is that industries operate within different kinds of regional contexts and that it is important for these not to be confused. The significance of the distinction between different interpretations lies in the implied scope for policy action to stimulate growth and competitiveness in different types of regions. In empirical analysis there is a need for great care in recognising the distinctions between different types of spatial externality especially in view of the policy significance currently assigned to clusters and innovative milieu.

In particular, arguments drawing on elements of the role of intermediate demand; social-network model and knowledge bases literature substantially enlarge the scope for effective intervention. Indeed, critical recent investigations indicate that there is no well-defined relationship between the location of innovative activities and regional spatial structure which is applicable to any wide range of sectors (Gordon and McCann, 2000). KIBS should lie at the core of any such analysis as their functions are perceived as key in generating and diffusing knowledge across space and promoting regional development.

The conceptual division between the two scholarly traditions namely economic geography and innovation studies resulted in the emergence of two separate streams of KIBS literature. Geographers, who are preoccupied with KIBS location, often neglect the systems and innovation perspective (including national, regional and sectoral) including the role of knowledge. At the same time many innovation scholars tend to neglect the geographic context under which KIBS operate. Also, geographers emphasise the importance of KIBS/customer interaction, whereas innovation scholars recognise that KIBS may operate as a separate sector, innovative in their own right (see for example, Tether, 2005; Camacho and Rodriguez, 2008; Corrocher et al., 2008; Doloreux et al., 2010).

The aim of this thesis is to bridge the gap between these two scholarly traditions. This task is relevant as to fully appreciate the role which KIBS play in the innovation systems, local, national and international, their location patterns, sources of demand, sectoral knowledge bases as well as factors that facilitate their innovativeness should be investigated together. Figure 1 (Chapter 1) represents the thesis model which attempts to graphically represent how this research proposes to make a conceptual connection between geography of KIBS, differentiated knowledge bases and KIBS own innovation.

This thesis provides original empirical evidence regarding the role of KIBS in enhancing economic success of de-industrialised regions in the UK. It also makes a contribution that fills theoretical and empirical gaps in understanding the link between innovation, location dynamics of KIBS SME's and differentiated knowledge bases. It seeks to provide a deeper understanding of the contribution of external knowledge sourcing channels (such as customers, competitors, clusters, universities, networks, formal alliances, supply chain networks, informal networks and so on) on KIBS SMEs innovativeness as well as implications for regional development policy.

Policy implications which arise as a result of this research can be related to other regions which have experienced de-industrialisation. Historically, innovation policy has dealt with the challenge of improving regions' local innovation capacity by focusing either on knowledge creation mechanisms (R&D activities, universities) or knowledge exploitation activities (university spin-offs, the creation of new firms). This focus on domestic innovation capacity has assumed that most knowledge needed for innovation will have to come from within territorial boundaries of the certain jurisdiction. Governments have therefore sought to increase knowledge transfer between local players within such boundaries. It should be noted, however, that as KIBS expertise is associated with economic growth, KIBS can be treated as factors of production along capital and labour (Miles, 2005).

Also, many studies have already investigated international learning in large firms through mergers and acquisitions, alliances, intra-firm knowledge transfer and international sourcing and international learning and knowledge transfer through academia. However, less is known about the learning of SMEs in a globalised knowledge environment. Further, de-industrialisation may pose serious challenges to those KIBS which depend largely on manufacturing demand. In this instance regional policies may be devised with the aim of achieving technological upgrading of old industrial formations (supporting local manufacturing as well as KIBS at the same time).

The conceptual approach adopted in this thesis is to consider KIBS as part of a wide economic system. This approach incorporates the geographic dimension as well as systems of innovation perspective (Lundvall, 1992) but at the same time recognises the importance of location and inter-sectoral linkages which shape KIBS industrial specialisation. It is acknowledged that KIBS may operate and draw upon resources from a wider, global economy well beyond regional and national borders acknowledging that local and regional as well as extra regional and international knowledge flows may be complementary for innovation. This is similar to “local buzz and global pipelines” (Bathelt et al., 2004).

Moreover, the sectoral systems framework is employed in Chapter 7 with the purpose of establishing patterns of technological learning and knowledge sourcing for innovation in different KIBS sub-sectors. The aim is to assess characteristics of different KIBS as sources and facilitators of knowledge across space. Another interesting question is what makes de-industrialised locations attractive for entrepreneurs and whether KIBS are sufficiently “footloose” to be attracted to such locations? Therefore this thesis contributes towards better understanding of KIBS location decisions. The next chapter aims to set the scene by establishing regional industrial specialisation in KIBS and other sectors in the two case study regions. Emphasis is also placed on a more recent economic history and effects of the most recent economic downturn on employment in KIBS and other industries. The analysis is based on the former Government Office Regions (GORs).

CHAPTER 3: THE REGIONAL CONTEXT

3.1 Introduction

This chapter aims to undertake an examination of the regional industrial specialisation of the two case study regions (the North East and the West Midlands) in KIBS and other industries and to compare those to the UK average. The analysis is placed in the context of recent economic history of the two regions. The data was also collected to examine economic performance of the two regions by looking into: Gross Value Added (GVA), recent employment and unemployment trends, international competitiveness and skills. In order to investigate the regional industrial specialisation, the Location Quotients (LQ) are applied in the analysis in order to identify concentrations of economic activity by sector[14].

This chapter also aims to contribute to a better understanding of the prospects for future KIBS led development in de-industrialised regions in the context of the most recent economic downturn. The chapter describes characteristics of the KIBS sub-sectors by size, their contribution to GVA and turnover. The analysis is based on the secondary data relating to GVA, employment and unemployment, international competitiveness and skills, available from the Office for National Statistics (ONS) covering the period 2007-2014. In addition, the analysis includes quarterly employment estimates for 2008-2012, available from the ONS and the Business Register and Employment Survey (BRES) covering the period 2009-2014.

Previous research shows that proximity to major urban centres has been a significant determining factor of KIBS location for decades. To the

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[14] LQ is an analytical tool used for identifying concentrations of economic activity by sector and place. The LQ method compares local economy to a reference economy whilst identifying specialisations. LQ s are calculated by dividing the percentage of the national total for a particular group of workers in a given area by the percentage of the national total for all workers found in that area. If the quotient is greater than 1 this means that the area's labour force is more biased towards the particular group while a quotient of 2 means that the area has twice as many people as expected.

<1	No localisation
1-<1.5	Weak localisation
1.5-<3	Strong localisation
3-<6	Very strong localisation
6+	Extreme localisation

Source: Bryson and Taylor (2009)

best of the author's knowledge there are no published studies which provide updated information on KIBS spatial characteristics within the UK, regional and sub-regional levels. Hence, this chapter aims to identify main themes, what sectors are involved, what is the regional concentration of KIBS in the two case study regions, what are the key trends and to provide time-series analysis of changes in KIBS employment.

3.2 Economic Performance of the North East and the West Midlands

First, in order to provide an overview of the recent economic performance of the two case study regions, this section discusses a selection of economic indicators. The discussion includes analysis of regional and national data on economic output, productivity and the labour market. Regional and national indicators on innovation and exports, competition and skills are also discussed. This section analyses long-term trends and changes covering the period 2007-2014.

Gross Value Added (GVA)

Between 2011 and 2012 most UK regions, apart from the East Midlands, saw an increase in GVA[15] (Table 3.1). ONS Nominal GVA data are available from 2007. This data shows that GVA has grown in almost every year across all regions in the UK, with the only exception during the latest economic downturn in 2008 and 2009. In 2009, the North East saw the biggest contraction (-3.5%) (ONS, 2014). Most regions, however, returned to nominal GVA growth in 2010.

[15] GVA is the value generated by any unit engaged in production activity. GVA plus taxes (less subsidies) on products is equivalent to Gross Domestic Product (GDP). The data used here are produced by the ONS, using the income approach to calculating GVA.

Table 3.1: Total nominal GVA by region/country

	Total GVA (£ billion)		Percentage change
	2011	2012	
London	303.4	309.3	2
South East	196.1	202.6	3.3
North West	127.9	130.6	2.2
East	114.3	116.1	1.6
Scotland	105.9	106.3	0.4
South West	100.4	101.6	1.2
West Midlands	**97.1**	**98.3**	**1.3**
Yorkshire and The Humber	92.5	93.3	1
East Midlands	79.7	79.7	0
Wales	46.5	47.3	1.9
North East	**41.2**	**41.9**	**1.7**
Northern Ireland	29.1	29.4	1.2
United Kingdom	1,360.90	1,383.10	1.6

Source: Office for National Statistics

This growth was strongest in London and the South East (ONS, 2014). Most regions have seen a very slight decline in their share of the UK's GVA, but London has seen its share rise. The region with the greatest decline was the West Midlands, where the regional share of the UK's GVA fell from 8.2% in 1997 to 7.2% in 2012, a difference of 0.9% (ONS, 2014, 6).

Labour productivity is a measure of the efficiency of production. It is the ratio of output produced to the inputs required in the production process. Productivity growth is essential for economic growth. If there is growth in productivity this means that the economy is producing a higher level of output with the same level of inputs. Innovation, skills, investment etc. are just a few drivers of productivity growth.

Table 3.2 GVA per filled job and GVA per hour worked (UK = 100), 2012

	London	South East	Scotland	East	North West	South West	**North East**	Yorkshire and The Humber	**West Midlands**	East Midlands	Wales	Northern Ireland
GVA per filled job	140.9	105.4	95.5	95.6	91.1	87.9	**87.0**	87.2	**87.5**	85.5	82.0	85.0
GVA per hour worked	131.2	107.7	97.4	96.4	91.7	91.6	**89.3**	87.8	**87.1**	86.1	85.2	82.8

Source: Office for National Statistics

Table 3.2 shows that London was the most productive region in the UK in 2012. Worker characteristics constitute a large part of the difference in productivity between the regions. For example, London has a higher share of graduate workers than other regions which helps to raise its relative productivity level. Other aspects such as innovation and benefits accruing from agglomeration economies may also drive up productivity levels (ONS, 2014).

Employment

The employment rate provides a share of the total labour force (people aged from 16 to 64) in employment. Table 3.3 shows that employment rate has increased in every region in the UK over the twelve months to February-April 2014. Of these, biggest increase in employment was in the North East (rising 2.9%).

Table 3.3 Change in employment rates from previous year

	Feb-Apr 2013	Feb-Apr 2014	% point change
North East	**66.6**	**69.5**	**2.9**
North West	69.7	70	0.3
Yorkshire and The Humber	70.4	72	1.6
East Midlands	71	73.8	2.8
West Midlands	**69.9**	**70.2**	**0.3**
East	74.5	75.9	1.4
London	70.2	72.3	2.1
South East	74.8	76.4	1.6
South West	74.7	76.1	1.4
Wales	69.4	70.1	0.7
Scotland	72.2	73.4	1.2
Northern Ireland	67.1	68.1	1

Source: Office for National Statistics

Unemployment rate is calculated according to the International Labour Organisation (ILO) definition. It divides the number of unemployed by the number of economically active for those aged 16 and over. With the most recent economic downturn the North East saw a particularly high increase in unemployment rate from 2008 onwards, peaking at 12% in the three months to November 2011 (ONS, 2014). The largest fall in unemployment between February to April 2013 to February to April 2014 was in the West Midlands falling to 7.5 (Table 3.4). Despite some relative recent improvements in employment in both regions as well as decrease in unemployment in the West Midlands, high levels of unemployment were persistently recorded in the two case study regions in the past. The most obvious effect of the changing geography of production in de-industrialised regions has in effect been increase of unemployment.

Table 3.4 Change in unemployment rates from previous year

	Feb-Apr 2013	**Feb-Apr 2014**	**Percentage point change**
North East	**10.1**	**9.8**	**-0.3**
North West	7.9	7.6	-0.3
Yorkshire and The Humber	8.9	8.2	-0.7
East Midlands	7.8	6.1	-1.7
West Midlands	**9.4**	**7.5**	**-1.9**
East	6.7	5.3	-1.4
London	8.5	7.5	-1
South East	6.6	4.8	-1.8
South West	6.2	4.9	-1.3
Wales	8.4	6.6	-1.8
Scotland	7.1	6.6	-0.5
Northern Ireland	7.8	6.9	-0.9

Source: Office for National Statistics

Skills

Table 3.5 shows that in 2013 the West Midlands had the second highest rate of people aged 16 to 64 with no qualifications (13.6%). The West Midlands and the North East each have above the national average rate of people aged 16 to 64 with no qualifications.

Table 3.5 Share of 16-64 year olds with no qualifications, 2013

	No Qualifications
United Kingdom	9.5%
Northern Ireland	17.2%
West Midlands	**13.6%**
North West	11.0%
North East	**10.7%**
Wales	10.6%
Yorkshire and the Humber	10.4%
East Midlands	10.3%
Scotland	10.3%
East	8.4%
London	7.8%
South West	6.6%
South East	6.5%

Source: Annual Population Survey, ONS

International Competitiveness

The data in this section relate to a number of businesses registered for Value Added Tax (VAT) or Pay as You Earn (PAYE) that were active at some point in the calendar year. HM Revenue and Customs (HMRC) publish statistics on regional trade in goods to the EU and non-EU countries. This particular statistics does not include trade in services, nor trade between countries or regions within the UK.

Table 3.6 shows the value of exported goods as a percentage of work place based regional GVA for selected regions. In 2012, exports of goods as a percentage of GVA were highest in the North East (30.8%) and lowest in London (11.3%). Over the period 2007 to 2012 all regions experienced growth in tangible exports as a share of their GVA. This includes the West Midlands which saw a substantial increase in exported goods as a share of GVA, from 16.5% to 23.2%.

Table 3.6 also shows that as the effects of the economic downturn were felt, between 2008 and 2009, goods exports as a share of GVA declined in every region except Scotland. Observing the period 2011 to 2012, while most regions suffered a slight decline in exports (apart from the North East which notes a slight increase), exports in the West Midlands increased from 22% to 23.2%. In the West Midlands and the North East "Machinery and Transport" was the largest sector for exported goods in 2013 (ONS, 2014).

Table 3.6 Total exported goods as percentage of GVA for selected regions

	North East	Wales	**West Midlands**	Northern Ireland	South West	London
2007	**24.4%**	20.3%	**16.5%**	18.4%	11.4%	8.4%
2008	**27.4%**	28.4%	**18.7%**	21.4%	12.8%	8.8%
2009	**23.9%**	24.8%	**15.9%**	18.5%	11.3%	8.1%
2010	**27.9%**	28.9%	**19.4%**	18.8%	11.6%	10.2%
2011	**30.6%**	31.9%	**22.0%**	20.3%	12.9%	11.9%
2012	**30.8%**	28.1%	**23.2%**	19.1%	12.5%	11.3%

Source: Office for National Statistics

The fact that the North East and the West Midlands perform strongly in manufacturing exports is related to their historical industrial specialisation profile. Figure 3.1 shows that both case study regions exhibit relatively strong specialisation in manufacturing. The West Midlands is the second most specialised region in manufacturing compared to the national average. The comparison with London and the South East shows that there are remarkable differences between industrial regional profiles of London, wider South East and Scotland, on the one hand, and the rest of the UK on the other. Next section aims to describe the industrial profile of the two regions in more detail, discussing similarities and differences between them.

Figure 3.1: Location quotients by region, 2011
Manufacturing (SIC, C)

Source: Office for National Statistics

3.3 Industrial Structure of the North East and the West Midlands

The North East and the West Midlands have a long tradition in manufacturing where production started during the industrial revolution and grew rapidly throughout the 19th century. During this period, in most recently de-industrialised regions, the production was organised around coal mining, chemicals, iron, steel and related metal processing industries (engineering, railways, shipbuilding etc.) (Hudson, 1988). Subsequent decline of “old” industries is often associated with increased competition from abroad and low levels of productivity at home. Even as early as the 1930s and onwards these regions suffered from cyclical mass unemployment (Hudson, 1988).

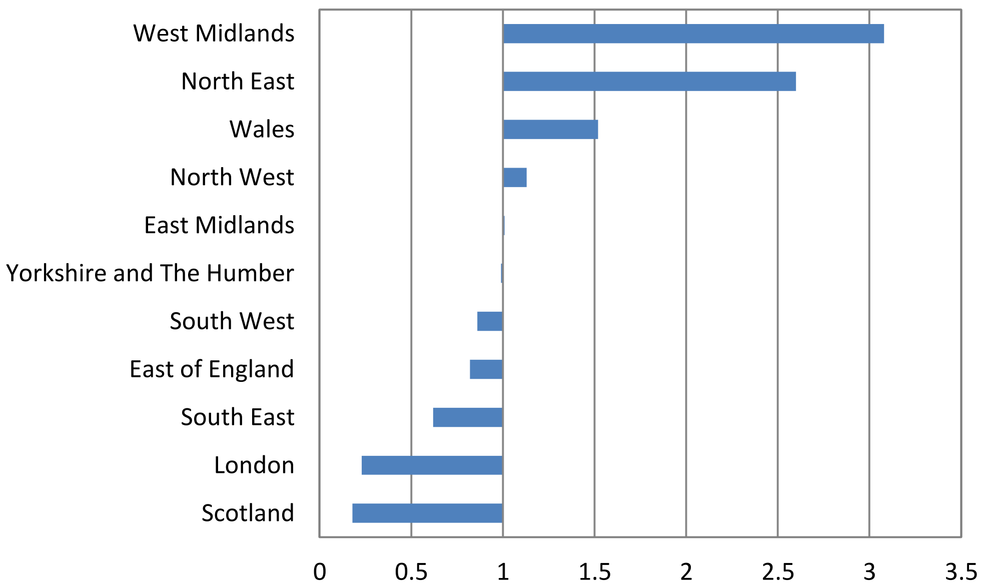
Prior to the 1950s there was very little change in the patterns of production and labour profile in de-industrialised regions. Despite some efforts to diversify the industrial structure and labour markets in 1960s, via various national state policies, both regions remained dependent upon their "old" industries. These patterns still shape the industrial profile of the North East and the West Midlands. Despite these similarities, it should be noted that there are some notable differences between the two regions (including smaller localities within them), in their industrial profile which are explored in this section.

The continued importance of manufacturing in the North East and the West Midlands is clearly highlighted in Figure 3.1 and the importance of automotive sector in these two regions is evident in Figure 3.2 Despite job losses in manufacturing sector overall, employment levels continue to increase and this is particularly true in case of the automotive sector in the North East (NELEP, 2013). The Tees Valley and the wider North East are two of the UK's principal locations for automotive manufacturing. The industry has developed through updating the area's traditional skill base and infrastructure and maintaining its long-standing specialism in engineering. More recent developments in the automotive industry in the North East include electric vehicle production which began in Sunderland in 2013. A remarkable investment in the battery plant and Nissan LEAF production had supported an estimated 2,000 jobs at Nissan and in its UK supply chain.

The proportion of automotive manufacturing in the West Midlands is 3.1 times the national average (Figure 3.2). Manufacture of basic metals and in particular machine tool manufacture and manufacture of motor vehicles and parts are predominantly based in Birmingham and Black Country and Coventry conurbations. Recently, Birmingham and the wider West Midlands region has been particularly hard hit due to a number of high profile plant closures in the automotive sector. These closures include, most notably, Jaguar plant closure in Coventry in 2005, MG Rover in Birmingham in 2005, Peugeot near Coventry in 2006 and LDV in Birmingham in 2009 (Bentley, 2007). In parallel, there has been a decline in activities by major suppliers as Bosch which closed its automotive lighting plant in the north of the region and TRW its electric power steering plant in Birmingham (Bailey et al., 2014).

However, in parallel to the decline in manufacturing there has been a relative growth of higher value specialist production where profit margins are much higher (Bailey et al., 2014). Examples include some medium size companies such as Aston Martin and smaller scale producers such as sports car producer Morgan Motors (Bailey et al, 2014). Jaguar Land Rover (JLR) and Aston Martin support significant local supply chain and help drive innovation and engineering skills. Other key automotive sector brands include Geeley, making London cabs in Coventry and Dennis Eagle, making refuse lorries in Warwick. In total, the West Midlands has ten vehicle assembly plants and two engine plants. The 29% of all cars produced in the UK are made in the Midlands.

Figure 3.2: Location quotients by region, 2011
Manufacture of motor vehicles, trailers and semi-trailers (SIC, 29)



Source: Office for National Statistics

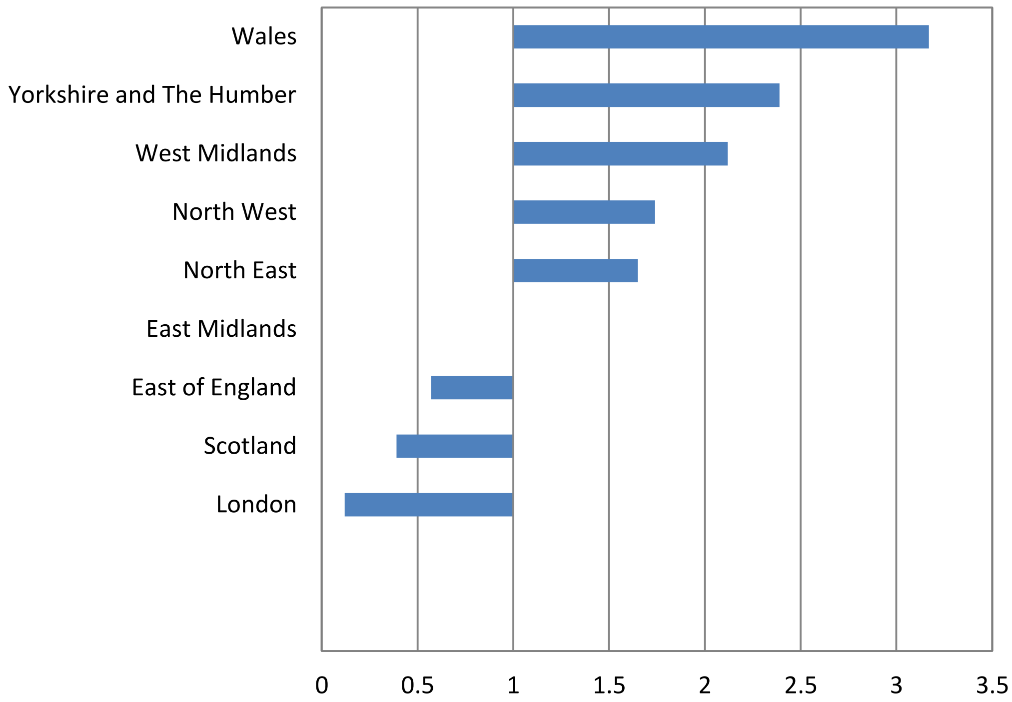
Figure 3.3: Location quotients by region, 2011
Manufacture of machinery and equipment n.e.c. (SIC, 28)

Source: Office for National Statistics

Both case study regions also specialise in production of machinery and equipment (Figure 3.3) as well as manufacture of basic metals such as iron (Figure 3.4). Related to the automotive manufacturing is metal based manufacturing which is 2.1 times higher than the national average in the West Midlands. Employment in metal manufacturing has fallen in the West Midlands by over 35% from 1998 to 2005, however, the output has fallen less sharply (13%), which indicates that the remaining metals manufacture has become more productive (Clayton and Lee, 2009).

Figure 3.4: Location quotients by region, 2011

Manufacture of basic metals (SIC, 24)



Source: Office for National Statistics

Electrical equipment includes any machine powered by electricity. It usually consists of an enclosure, a variety of electrical components, and often a power switch. Examples of these include: major appliances; microcontroller; power tool and small appliances. The North East exhibits relative specialisation in manufacture of electrical equipment with production dispersed in different parts of the region.

Figure 3.5: Location quotients by region, 2011
Manufacture of electrical equipment (SIC, 27)

Source: Office for National Statistics

Figure 3.6: Location quotients by region, 2011
Manufacture of rubber and plastic products (SIC, 22)

Source: Office for National Statistics

For the whole of the West Midlands region, the proportion of regional employment in the manufacture of rubber and plastics is close to 1.5 times the national average. This sector is relatively geographically dispersed across the region. Manufacture of rubber and plastics is concentrated in the following local authority areas in the West Midlands: Herefordshire, North Warwickshire, Telford and Wrekin, Tamworth, Malvern Hills, Stoke-on-Trent, Wychavon, Cannock Chase, Dudley, Worchester, Lichfield, Redditch, South Staffordshire, Wolverhampton, Sandwell and Walsall. All of the above listed areas have a location quotient of 1.5 and higher for this particular industry.

Industries such as chemicals and bio fuels lie at the centre of the North East economy (Figure 3.7) and particularly in Teeside. Teeside is home to the largest integrated chemical complex in the UK and the second largest in Western Europe in terms of manufacturing capacity. All types of chemicals are represented, from petroleum processing and hydrocarbon separation activities, through petrochemical manufacture and fine speciality chemicals to pharmaceutical intermediates and actives. The West Midlands, however, does not have significant capacity in chemicals.

Figure 3.7: Location quotients by region, 2011
Manufacture of chemicals and chemical products (SIC, 20)

Source: Office for National Statistics

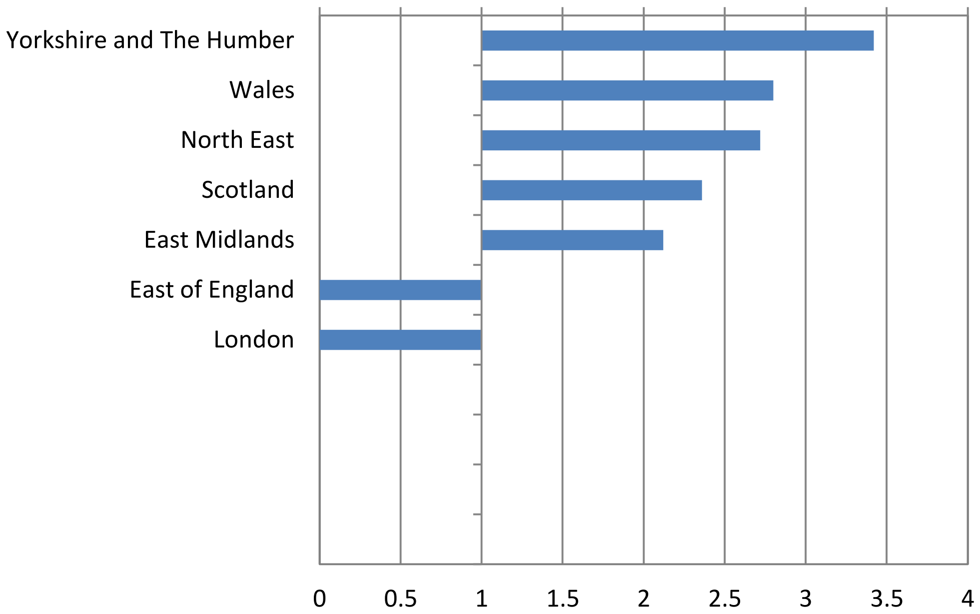
Life science sector is important in the North East economy and relatively underrepresented in the West Midlands (Figure 3.8). This sector covers pharmaceuticals, biotechnology and medical devices. The North East has a medium sized cluster of companies in this sector with strengths in drug manufacture, diagnostics and assistive technology.

Figure 3.8: Location quotients by region, 2011
Manufacture of basic pharmaceutical products and pharmaceutical preparations (SIC, 21)

Source: Office for National Statistics

West Midland's "Black Country" was in the past famous for its mines but since the 1980s coal mining was in decline in the UK due to an increased use of natural gas in power stations and cheaper imports. Very few working coal mines and open-cast quarries now exist in Britain. However, Figure 3.9 shows that the North East still specialises in mining of coal and lignite.

Figure 3.9: Location quotients by region, 2011
Mining of coal and lignite (SIC, 05)



Source: Office for National Statistics

Differences in the industrial profile of the two regions largely stem from their geographical position, availability of natural resources and their respective economic history. The North East is the smallest of the nine English regions in both area and population. It is a region at the periphery of the UK. It is a small and remote region with extensive rural areas and three river-based conurbations. It has reasonably clear physical boundaries and strong regional characteristics. The small population of 2.5 million is ageing and in contrast to other English regions, declining (OECD, 2006). Over a long period, starting from the Industrial Revolution, the North East used to be one of Great Britain's main industrial centres. Industry was based on coal mining in Northumberland and Durham, shipbuilding and heavy engineering in Tyne and Wear and steel production in Teeside. During the mid and later decades of the 20th century the region experienced massive de-industrialisation and economic decline, resulting in a widening gap between the North East and the national average.

From the early 70s onwards the region suffered a further decline of its coalmining, shipbuilding, heavy iron, steel and chemical industries. The government response included provision of the financial aid to try and mitigate losses in these industries. Since the mid-1970s government's financial aid has been declining and the measures from then on included attracting inward investment such as branch plants. In addition, the service sector did compensate for some male job losses, thus filled by women. These new service jobs consist mainly of government administration, retailing and call centres (mostly low wage and part-time employment). Further, regional economy suffered as a result of over-representation of externally controlled branch plants (given their tendency to migrate production to lower cost locations abroad) and the under representation of innovative SMEs (OECD, 2006).

Given recent trends towards out-migration of foreign companies to low cost locations in other countries, the absence of public research establishments and the low levels of R&D in the private sector, universities are increasingly seen as the key contributors to the innovativeness (OECD, 2006). There are five universities and the Northern Office of the Open University. They are diverse institutions, growing in size and income, with a significant regional presence and an estimated 2% contribution to the region's GDP (OECD, 2006). There are two research-intensive universities, Durham and Newcastle, three new universities that were formerly polytechnics, and twenty-three further education colleges. Few universities have strong links with local engineering businesses. For example, Teeside University excels in disciplines such as engineering, process and energy sectors, where mechanical engineering courses meet specific needs of the local engineering supply chain.

Other distinctive features of the North East economy include relatively strong performance in manufacturing exports and strong reliance on public sector employment. In 2010, the largest sector in terms of output was manufacturing, which generated 15.5% of the region's total GVA. This was followed by human health and social work at 11%. In 2011, the value of goods exported relative to the size of the local economy was greatest in the North East at 33% of the GVA, compared to the UK average of 22%. In both 2011 and 2012, the North East was the only region in England to record a trade surplus of goods. Over a fifth of employed people in the region worked in the public sector in Q4 of 2012 (22.6%), the highest proportion amongst the English regions. The North East region's total GVA in 2011 was £41.4 billion, 3.2% of the UK's GVA whereas Tyneside generated 38% of the region's GVA.

The North East economy has a number of structural weaknesses. These can be summarised as: too few private sector jobs and enterprises, too few KIBS jobs and lower levels of productivity (NELEP, 2013). However, the North East is well placed to lead the way in developing low carbon economy. Main opportunities include electric vehicles and offshore wind turbine markets (NELEP, 2012). The main industrial opportunities for electric vehicles are located in and around the south of the North East region. These build on very strong low carbon consultancy skills and technical expertise in manufacturing, engineering, energy and science. Electric power generation is also an important sector in the North East. Oil and gas sector employs around 440,000 jobs in the UK economy and approximately 15% of these within the North East region (NELEP, 2012). Power generation based on renewable energy such as wind, wave, marine etc. is becoming increasingly important in the North East.

The West Midlands is a complex region which includes the UK's second largest city, Birmingham. The West Midlands is the most industrialised region in the UK and there is generally underrepresentation of employment within service industries (Clayton and Lee, 2009). Parts of the region were traditionally associated with metal based manufacturing, plastics and rubber, software, food and drinks, electronics and telecommunications and a range of business and professional services (Bryson and Taylor, 2009). However, although there is significant employment in KIBS there is no significant concentration of employment in these sectors compared to the UK as a whole.

Following a fall in the employment rate recorded in 2008 and 2009, the region's employment rate subsequently increased between Q4 2010 and Q4 2012 by 2.8%. The unemployment rate increased between Q4 2007 and Q4 2012, from 5.8% to 8.6%. Within the region, the rate ranged from 14.3% in Birmingham to 3.8% in Stratford on Avon ending in December 2012. Gross disposable household income of the West Midlands residents was one of the lowest among the English regions at

£14,400 per head in 2011. It ranged from £12,470 per head in Stoke-on-Trent to £17,360 per head in Solihull.

Recently, the Science City initiative has led to collaborative working between the region's two largest research universities, Warwick and Birmingham, to strengthen the region's research base and improve knowledge transfer in energy, translational medicine and advanced materials. Also, advanced manufacturing cluster has been formed around Warwick University. Previous report (Bryson and Taylor, 2009) argues that the sectors which are most likely to guide and underpin the future West Midlands economy are: R&D, Miscellaneous Manufacturing; Manufacture of Office Machinery and Computers. The location of employment in the above sectors varies considerably across the region. Sectoral location is influenced by a variety of factors such as availability of transport and infrastructure, land and labour, local economic structure and existing firm base as well as historical factors (Clayton and Lee, 2009).

Further analysis proceeds by looking at the regional concentration of the Financial Sector and other KIBS. Figure 3.10 shows that in the West Midlands and the North East financial services account for a relatively small proportion of employment. Within the West Midlands the financial services are concentrated in Birmingham. KIBS in general are highly concentrated in Birmingham city centre. In addition, a second tier of KIBS surrounds Birmingham and Black Country conurbation, stretching to the south east of the region (Daniels and Bryson, 2005). The location of the Birmingham city region in close proximity to London may result in an inward movement by London and the South East based KIBS posing threat to a more proactive West Midlands based KIBS (Daniels and Bryson, 2005).

The long term sustainability of the West Midlands KIBS is dependent on the region's economic base as well as geographic networks within which KIBS are embedded (Daniels and Bryson, 2005). On the one hand, too much reliance on local customer base may result in negatives associated with local economic restructuring but on the other, total disengagement and the danger of firms potentially dislocating and moving closer to their clients (Daniels and Bryson, 2005, 522). These two possible extreme scenarios highlight the fact that the role which KIBS play in the economic development of regions may be conditional on intangibles related to quality of the environment and relationship networks rather than proximity to customers or benefits of agglomeration (see Chapter 2).

Financial services are concentrated in Central London (Figure 3.10), the core cities in the North and the South and some larger cities in the South such as Brighton, Bournemouth, Swindon, Milton Keynes, Norwich and Ipswich (Wood, 2010). Figures 3.11 to 3.18 show that London and the South East exhibit particularly strong specialisation in all types of KIBS. Generally, KIBS mostly gravitate towards London. There is no doubt that many London and the South East financial services and KIBS are truly global.

Figure 3.10: Location quotients by region, 2011

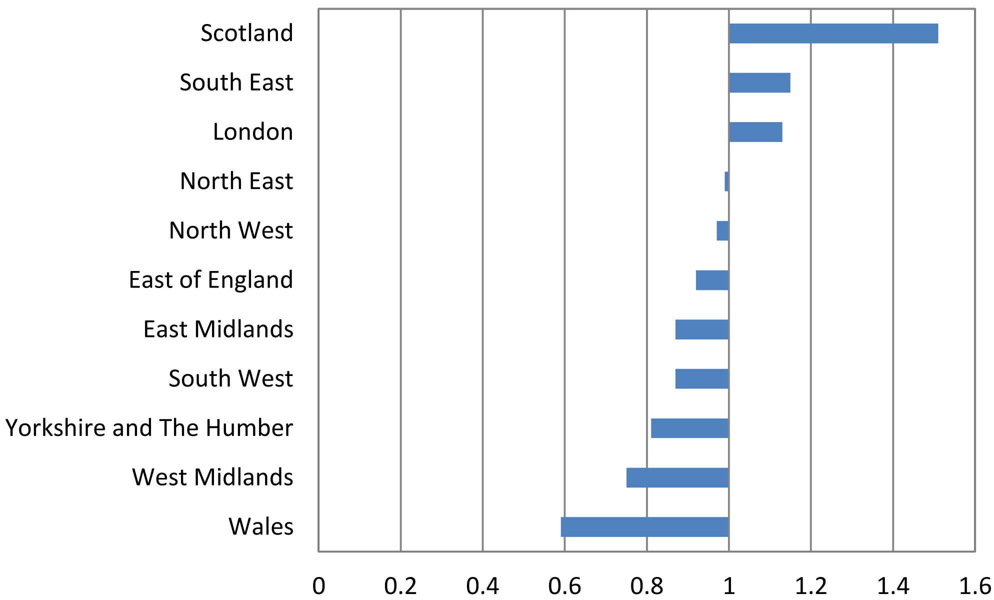
Financial service activities, except insurance and pension funding (SIC, 64)

Source: Office for National Statistics

Figure 3.11: Location quotients by region, 2011
Computer programming, consultancy and related activities (SIC, 62

Source: Office for National Statistics

Figure 3.12: Location quotients by region, 2011
Architectural and engineering activities and related technical consultancy (SIC, 711)



Source: Office for National Statistics

Figure 3.13a: Location quotients by region, 2011
Publishing of books, periodicals and other publishing activities (SIC, 581

Source: Office for National Statistics

Figure 3.13b: Location quotients by region, 2011
Software publishing (SIC, 582)

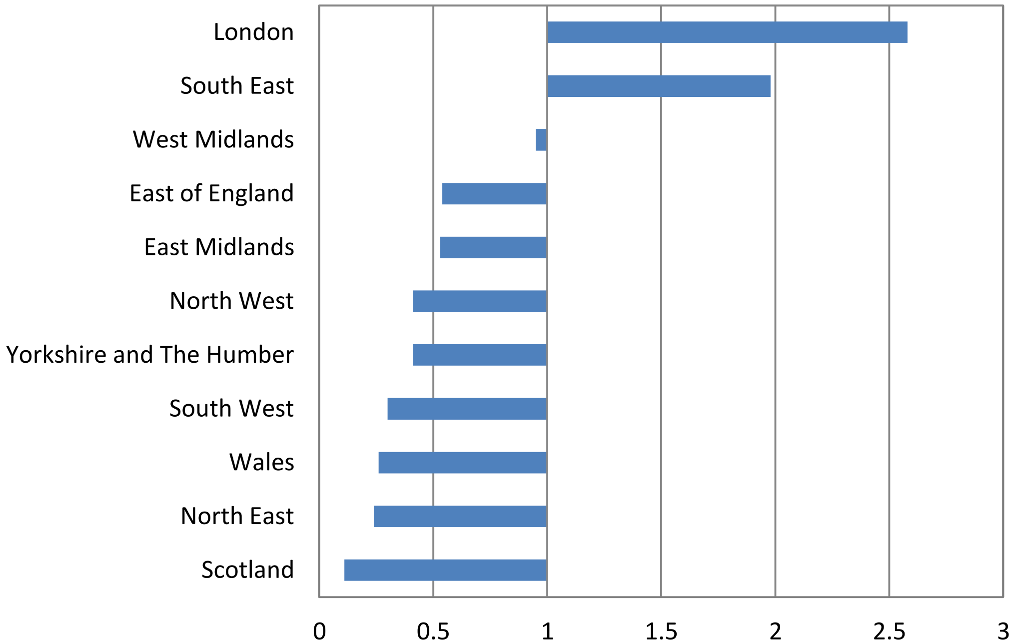
Source: Office for National Statistics

Figures 3.11; 3.12; 3.13a and 3.13b show that in Computer programming consultancy and related activities; Architectural and engineering activities and related technical consultancy as well as

Publishing and Software publishing, the North East and the West Midlands exibit similarities in terms of evident underspecialisation in these KIBS.

Currently, Teeside in the North East is home to some of the major engineering companies in engineering design, subsea and offshore, process industries (chemical, pharmaceutical, industrial biotech), bio energy, offshore wind, marine renewables, fuel cells and electric vehicles. Tyneside and Tees Valley both have the skills and technologies to tackle subsea challenges, whereas Tees Valley also has a cluster of internationally successful firms. The North East subsea engineering cluster is one of the region's recent success stories. In the last 30 years it has grown to employing around 15,000 people and over 50 firms. It began by helping develop technologies required to recover oil and gas from production facilities on the seabed. These technologies are currently applied to the offshore wind, telecommunications and will be used to mine subsea minerals in the future.

Figure 3.14: Location quotients by region, 2011
Market research and public opinion polling (SIC, 732)



Source: Office for National Statistics

Figure 3.15: Location quotients by region, 2011

Advertising (SIC, 731)

Source: Office for National Statistics

Source: Office for National Statistics

Figure 3.16: Location quotients by region, 2011

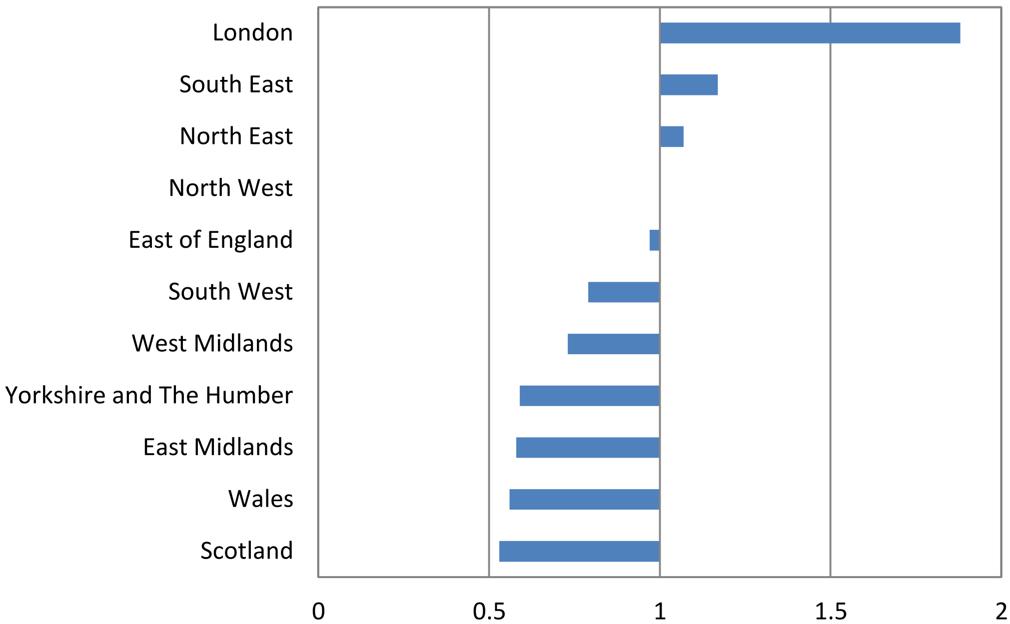
Research and experimental development on natural sciences and engineering (SIC, 721)

Source: Office for National Statistics

Figures 3.14; 3.15 and 3.16 show that some differences do exist between the two regions in their respective concentration of Market research; Advertising and Research and development activities in natural sciences and engineering. Figure 3.14 shows that the West Midlands has proportionately higher concentration of employment in Market research (Figure 3.14) and Advertising (Figure 3.15) compared to the North East. However, employment in Research and development is relatively more concentrated in the North East and is higher than the UK average (Figure 3.16).

Figure 3.17: Location quotients by region, 2011

Management consultancy activities (SIC, 702)



Source: Office for National Statistics

Figure 3.18: Location quotients by region, 2011

Technical testing and analysis (SIC, 712)

Source: Office for National Statistics

Figure 3.17 shows that in the North East, Management consultancy activites are more important compared to the West Midlands whereas employment concentration in the North East is higher than the national average. Technical testing and analysis is more important in the West Midlands and Figure 3.18 shows location quotient for this sector which is higher than 1.5.

Analysis is this section shows that the manufacturing sector in both regions contributes to the economic base, bringing the revenue to the local economies. Nevertheless, since these two regions specialise in manufacturing, there is a substantial proportion of KIBS who are wholly or partially dependent on manufacturing. Moreover, since manufacturing accounts for a disproportionate share of exports, it has a unique role to play in the widely discussed economic rebalancing. A further important aspect of the secondary impact of manufacturing lies in its regional component as manufacturing output is not evenly spread across the country. Thus, while manufacturing output has decisively contracted in the

London and the South East, it remains of importance in the North East and the West Midlands. Thus, contrary to Bell's (1973) vision of post-industrial society and in line with Daniels and Bryson (2002) and Bryson and Daniels (2015) the above analysis suggests that technological change is *not* leading to a proces where services arise independently of manufacturing base in all regions. This view is in contrast to de-industrialisation thesis.

3.4 KIBS During and Post the Recent Economic Downturn

KIBS related research has largely been built on the assumption of continued KIBS growth (Wood, 2010). Since 2008, not only financial services have been affected by the economic crisis but also accountancy and business consultancy services, lawyers, advertising firms and IT related businesses, though this effect has been less pronounced in London. From 2008, regions especially affected by the financial downturn were: Yorkshire, Scotland and the North East (Lee, 2014). In this respect, the most recent economic crisis was different to the crisis of the early 1990s when London and the South East based KIBS and construction industry in particular suffered the most (Lee, 2014). Tables below trace employment effects for the UK and for the former government office regions (GORs).

Since 2008 the long term decline in manufacturing intensified in all UK regions, in particular the North East and the West Midlands (Table 3.8). Meanwhile, comparatively small decline was felt in financial services (Table 3.7). However, while other UK regions marked a decline in financial jobs, London marked an overall increase over the whole period. London suffered a decline in finance from 2008 to 2010, but from June 2010 recovery resumed. Compared to London, where estimated gain was 25,000 jobs from 2007-2012, other regions (apart from the South West and Northern Ireland where employment over the whole period remained unchanged) actually lost jobs in the financial industry (Table 3.7).

Table 3.7: Finance and Insurance: Change in employment June 2007-June 2012

	June 07-08	**June 08-09**	**June 09-10**	**June 10-11**	**June 11-12**	**07-12**
United Kingdom	20,000	-2,000	-80,000	12,000	20,000	**-30,000**
North East	**-2,000**	**0**	**-4,000**	**0**	**2,000**	**-4,000**
North West	1,000	7,000	-16,000	1,000	7,000	0
Yorkshire and The Humber	2,000	-5,000	-4,000	2,000	4,000	-1,000
East Midlands	-4,000	-7,000	-5,000	8,000	-3,000	-11,000
West Midlands	**0**	**2,000**	**-1,000**	**-7,000**	**-8,000**	**-14,000**
East	-3,000	-3,000	-13,000	6,000	3,000	-10,000
London	14,000	-6,000	-3,000	13,000	7,000	25,000
South East	3,000	11,000	-6,000	-11,000	1,000	-2,000
South West	1,000	6,000	-10,000	-3,000	6,000	0
Wales	-3,000	0	-6,000	1,000	3,000	-5,000
Scotland	8,000	-5,000	-11,000	-1,000	-1,000	-10,000
Northern Ireland	2,000	-1,000	0	0	-1,000	0

Source: Quarterly employment estimates, ONS
Note: Figures are rounded to the nearest thousand

Table 3.8 shows that in the West Midlands some of the highest job losses were estimated in manufacturing from 2007-2012 (46,000). London was also expected to suffer losses in manufacturing employment (53,000 jobs lost) but these have been largely offset by gains in the financial sector (Table 3.7). Relatively large loss of manufacturing employment is also noted in the North East (22,000 jobs lost) between 2007 and 2012. In common with the rest of the country, the employment in manufacturing fell during the recent economic crisis in the North East. It is argued that the region's strength in water resources and energy, its coastline as well as good higher education base are expected to support economic recovery and growth in the future (NELEP, 2012).

Table 3.8: Manufacturing: Change in employment June 2007-June 2012

	June 07-08	**June 08-09**	**June 09-10**	**June 10-11**	**June 11-12**	**07-12**
United Kingdom	-99,000	-228,000	-87,000	-6,000	86,000	**-334,000**
North East	**-4,000**	**-9,000**	**-4,000**	**-5,000**	**0**	**-22,000**
North West	-28,000	-3,000	-37,000	11,000	10,000	-47,000
Yorkshire and The Humber	-11,000	-23,000	-7,000	1,000	5,000	-35,000
East Midlands	-10,000	-15,000	0	-3,000	3,000	-25,000
West Midlands	**-12,000**	**-38,000**	**0**	**-5,000**	**9,000**	**-46,000**
East	-4,000	-25,000	-5,000	5,000	11,000	-18,000
London	-10,000	-34,000	5,000	-7,000	-7,000	-53,000
South East	-1,000	-33,000	4,000	-4,000	15,000	-19,000
South West	-1,000	-11,000	-6,000	-10,000	20,000	-8,000
Wales	-5,000	-17,000	-17,000	10,000	6,000	-23,000
Scotland	-15,000	-10,000	-18,000	1,000	15,000	-27,000
Northern Ireland	0	-7,000	-3,000	0	-2,000	-12,000

Source: Quarterly employment estimates, ONS
Note: Figures are rounded to the nearest thousand

Table 3.9: Professional, scientific and technological services: Change in employment June 2007-June 2012

	June 07-08	**June 08-09**	**June 09-10**	**June 10-11**	**June 11-12**	**07-12**
United Kingdom	61,000	41,000	53,000	-17,000	124,000	**262,000**
North East	**-6,000**	**14,000**	**0**	**2,000**	**6,000**	**16,000**
North West	-2,000	2,000	18,000	1,000	22,000	41,000
Yorkshire and The Humber	18,000	-6,000	-6,000	13,000	23,000	42,000
East Midlands	-2,000	14,000	-6,000	-5,000	-22,000	-21,000
West Midlands	**7,000**	**-6,000**	**-20,000**	**33,000**	**-15,000**	**-1,000**
East	3,000	-10,000	15,000	-21,000	11,000	-2,000
London	23,000	13,000	24,000	-32,000	29,000	57,000
South East	-11,000	26,000	21,000	-11,000	44,000	69,000
South West	24,000	-6,000	5,000	1,000	12,000	36,000
Wales	-5,000	0	8,000	-11,000	-2,000	-10,000
Scotland	12,000	1,000	-3,000	4,000	22,000	36,000
Northern Ireland	1,000	-1,000	-3,000	8,000	-4,000	1,000

Source: Quarterly employment estimates, ONS
Note: Figures are rounded to the nearest thousand

Table 3.9 shows that while London and the South East gained significantly in terms of increased KIBS employment from 2007-2012 (57,000 and 69,000 jobs respectively) a decline was estimated in the Professional, scientific and technical services in four UK regions; East Midlands, Wales, East and West Midlands. The North East showed only a moderate increase of KIBS employment (16,000) during this period (Table 3.9). Next, analysis by KIBS sub-sectors concentrates on changes in KIBS employment and uses BRES data for the period 2009-2014 (Tables 3.10-3.14). BRES data is more accurate compared to quarterly estimates as it is based on a survey of businesses.

Table 3.10: Computer programming, consultancy and related activities: Change in employment 2009-2014

	2009-2010	**2010-2011**	**2011-2012**	**2012-2013**	**2013-2014**	**2009-2014**
North East	**0**	**8,000**	**-5,300**	**-2,400**	**2,300**	**2,600**
North West	-6,800	6,600	200	300	4,200	4,600
Yorkshire and The Humber	-1,200	2,300	6,200	-2,600	9,800	14,500
East Midlands	1,900	-1,500	-5,500	14,100	-8,300	800
West Midlands	**3,500**	**-9,200**	**2,200**	**-1,400**	**7,400**	**2,400**
East	-100	1,400	3,900	3,700	14,700	23,600
London	21,000	10,800	-18,400	17,400	15,800	46,700
South East	6,400	13,000	-10,900	16,200	-5,100	19,700
South West	3,200	-1,800	-2,700	3,200	4,400	6,300
Wales	-800	0	600	-100	4,700	4,500
Scotland	-1,100	-1,700	1,900	3,800	800	3,600
Column Total	26,000	27,900	-27,800	52,200	50,800	129,200

Source: BRES, ONS
Note: Figures are rounded to the nearest hundred

Table 3.10 shows that employment in Computer programming; consultancy and related activities grew in all regions over the above stated period. However, majority of jobs were created in London (46,700 compared to only 2,600 and 2,400 respectively in the North East and the West Midlands). In the North East the most significant losses occurred between 2011 and 2013. In the West Midlands the greatest losses were noted during the period 2010-2011. Less pronounced losses were recorded in 2012-2013.

Table 3.11: Activities of head offices; management consultancy activities: Change in employment 2009-2014

	2009-2010	**2010-2011**	**2011-2012**	**2012-2013**	**2013-2014**	**2009-2014**
North East	**-1,200**	**7,900**	**-7,000**	**1,400**	**1,900**	**3,000**
North West	900	2,400	100	4,700	11,700	19,800
Yorkshire and The Humber	-400	1,200	-1,100	8,400	4,500	12,500
East Midlands	-4,400	-3,000	11,000	-1,000	4,000	6,600
West Midlands	**3,000**	**4,300**	**3,100**	**10,200**	**2,700**	**23,200**
East	8,300	-3,000	-900	14,900	6,700	25,900
London	400	-6,200	12,200	36,500	14,500	57,400
South East	-6,100	-1,200	6,900	-500	17,500	16,600
South West	-3,100	3,400	-2,600	-5,900	15,000	6,800
Wales	900	-700	-1,900	2,700	-400	700
Scotland	2,500	4,100	3,500	1,900	5,300	17,200
Column Total	800	9,200	23,200	73,400	83,300	189,900

Source: BRES, ONS
Note: Figures are rounded to the nearest hundred

Management consultancy and related activities continued to grow in all regions after the recession. The region which incurred most significant losses in this particular KIBS sub-sector, between 2011 and 2012, was the North East but it gained 3,000 jobs overall. The West Midlands gained the third largest proportion of jobs in this KIBS sub-sector (23,200) after London and the South East (Table 3.11).

Table 3.12: Architectural and engineering activities; technical testing and analysis: Change in employment 2009-2014

	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2009-2014
North East	**-1,600**	**1,600**	**-3,800**	**1,000**	**3,100**	**400**
North West	4,000	-3,200	1,300	4,200	400	6,700
Yorkshire and The Humber	-2,500	-1,400	5,300	1,000	-2,500	-100
East Midlands	2,500	3,900	-3,300	-3,400	13,500	13,200
West Midlands	**-5,600**	**-500**	**-2,900**	**7,600**	**-3,200**	**-4,600**
East	1,200	-2,000	3,400	-6,400	11,200	7,400
London	7,000	600	4,300	6,200	-8,200	9,900
South East	-8,100	-1,600	2,500	-900	22,800	14,600
South West	-3,100	100	-2,800	4,100	11,000	9,200
Wales	-1,400	-2,400	-300	3,900	3,200	2,900
Scotland	-3,300	-100	-2,500	8,100	-600	1,700
Column Total	-11,100	-5,100	1,400	25,300	50,800	61,300

Source: BRES, ONS
Note: Figures are rounded to the nearest hundred

Table 3.12 shows that only two regions suffered an overall decline in Architecture and engineering, technical testing and analysis sector and this includes the West Midlands (4,600 jobs lost) whereas the North East gained only a small number of jobs (400) during the period 2009-2012.

Table 3.13: Scientific research and development: Change in employment 2009-2014

Region	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2009-2014
North East	**1,300**	**100**	**-2,700**	**700**	**100**	**-500**
North West	1,100	1,900	-1,600	-1,400	-400	-400
Yorkshire and The Humber	-800	-500	4,400	-3,300	2,100	1,900
East Midlands	200	-1,500	200	2,300	-1,700	-500
West Midlands	**-1,000**	**800**	**500**	**-1,300**	**1,300**	**300**
East	200	-4,500	-600	2,400	3,800	1,400
London	2,100	3,700	-10,800	1,000	3,100	-900
South East	4,900	-3,000	-300	500	-1,900	300
South West	-1,000	-1,100	200	900	500	-500
Wales	300	-400	800	500	-700	600
Scotland	200	2,300	-200	-600	200	1,900
Column Total	7,700	-2,200	-10,100	1,700	6,300	3,500

Source: BRES, ONS
Note: rounded to the nearest hundred

The North East lost 500 jobs in Scientific research and development while the West Midlands gained 300 jobs in this sector between 2009 and 2012 (Table 3.13).

Table 3.14: Advertising and market research: Change in employment 2009-2014

Region	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2009-2014
North East	**0**	**-2,000**	**1,100**	**-500**	**500**	**-1,000**
North West	-3,500	3,100	-1,900	-1,000	-600	-4,000
Yorkshire and The Humber	2,900	-1,000	6,600	-3,000	-3,300	2,300
East Midlands	-7,900	-300	-600	1,900	400	-6,400
West Midlands	**-700**	**6,600**	**-4,800**	**-100**	**-500**	**700**
East	-1,400	-3,700	4,900	-1,100	400	-900
London	14,100	-6,900	12,300	12,200	-15,800	15,900
South East	6,100	1,400	-4,800	4,900	2,200	9,700
South West	600	600	600	-600	-300	900
Wales	-500	400	500	100	-300	200
Scotland	-1,500	-600	1,200	-1,100	-100	-2,200
Column Total	8,100	-2,500	15,100	11,700	-17,300	15,200

Source: BRES, ONS
Note: Figures are rounded to the nearest hundred

Table 3.14 shows that the West Midlands gained 700 jobs whereas the North East lost 1,000 jobs in Advertising and market research. The strongest performance is noted in London and the South East where 15,900 and 9,700 jobs have been gained between 2009 and 2014 in this KIBS sub-sector (Table 3.14).

On a sub-regional level, Wood (2010) shows that the most severe KIBS losses during the first two years of the recent recession were felt in the core cities and their hinterlands. Many smaller urban centres in the North also suffered significant losses as well as the financial freestanding centres of the South (these include Norwich, Ipswich, Brighton, Bournemouth, Swindon and Milton Keynes). With this exception, already existing North-South inequality in KIBS employment was reinforced by the most recent economic crisis as Central London and smaller centres and rural areas in the south generally sustained KIBS employment.

Intra-metropolitan location of producer services is important. Where are KIBS establishments located within the West Midlands and the North East? Tables 2.15 to 2.20 in the Appendix II, show analysis by different KIBS sub-sectors by Local Authority for the UK.

3.6 Conclusion

Analysis in this chapter shows that the West Midlands and the North East exhibit some notable similarities in their respective industrial profiles but some differences are evident too. In both regions there is above the average specialisation in manufacturing whereas the North East differs with respect to a higher than average specialisation in chemicals, pharmaceuticals and extractive industries, compared to West Midlands. These differences arise due to variation in resource base, geography and economic history of the two regions. Also, it can be concluded from the analysis in this chapter that modern geography of the UK KIBS is aligned with specific pattern of demand which differentiates London and the South East on one hand and that in de-industrialised regions on the other.

Further, employment analysis indicates that most KIBS in the North East and the West Midlands operate relatively locally. In core-city dominated economies such as England, KIBS in de-industrialised regions can be expected to make only a modest contribution to the local economic base. The analysis of employment in KIBS on a regional level shows continuing concentration of KIBS in London and the South East and this is in line with previous empirical studies (see for example, Wood, 2006; Chadwick et al., 2008). Despite the fact that KIBS employment growth in non-metropolitan regions has been relatively low compared to their metropolitan counterparts, both academics and policy makers should be reminded of the structural role KIBS play in their respective regions. This role consists of KIBS support to other sectors. Nevertheless, more empirical evidence from different regional settings is needed in order to be able to establish the importance of sectoral interdependencies between KIBS and sources of demand (Meliciani and Savona, 2014). This is because, when spatial proximity is essential and manufacturing clients are located outside metropolitan areas, manufacturing demand might counter-balance the centripetal forces which attract KIBS to major urban areas.

Further, in de-industrialised regions prospects for KIBS development may be rooted in regional demand from other services and public sector as well as extra regional demand from manufacturing. Many KIBS in de-industrialised regions may develop from its technological, resource, trading, public sector or educational bases (Wood, 2010, 2). They may develop out of expertise related to manufacturing, port, extractive and other functions which are more prominent outside London (Wood, 1012, 6). Regional KIBS entrepreneurship is likely to initially serve regional clients. Eventually they may develop and trade more widely and should be seen as a significant asset reducing reliance on outside KIBS, sustaining employment and developing specialist expertise (Wood, 2010, 3).

It has been noted elsewhere (see Wood, 2010, 11) that the most recent recession has transformed the context of debate, challenging easy assumptions about the inevitable growth of KIBS. This is because financial KIBS seem destined to become more regulated and employ fewer people than recently (Wood, 2010). For non-financial KIBS, however, regulatory arrangements are likely to remain unchanged (Wood and Wojcik, 2010). Employment growth in non-financial KIBS may not be as rapid as in the past, given shifts towards lower cost and offshore production which were under way before 2007 (Wood, 2010). It should be noted, however, that some North East and West Midlands KIBS sub-sectors have shown relative resilience despite declining manufacturing, financial and public sector demand during and after the most recent economic downturn.

Moreover, the above analysis indicates that demand for some KIBS may actually expand during the recession where prospects appear stronger among non-financial KIBS which are often supported by public sector demand. This seems to be the case with the IT related and Management consultancy KIBS in the North East and the West Midlands (see chapter 5). However, in the UK, policies to reduce national deficit are likely to result in a severe reduction of public sector jobs. The Office for Budget Responsibility forecasts that around 710,000 jobs in the public sector could be lost between the first quarter of 2011 and the first quarter of 2017. These job losses will impact particularly those places where the public sector provides a larger proportion of employment such as the North East and the West Midlands and may adversely affect KIBS sub-sectors in these regions.

On a sub-regional level, some important patterns of KIBS concentration emerge (see Appendix II). In the West Midlands it is attractive, amenities rich and well connected local areas in close proximity to London and the South East that exhibit good prospects for KBS development. These areas which include Telford and Wrekin, Stratford-on-Avon, Warwick and Malvern Hills seem to attract many professional KIBS. This is consistent with Keeble and Nachum's (2002) study, who found that many decentralised KIBS exist in amenities rich, attractive decentralised locations in the UK. In contrast, in the North East it is former industrial cities such as Stockton-on-Tees, Middlesbrough, Redcar and Cleveland that have developed KIBS functions. Some of these places in the North East have benefited from the government investment and regeneration efforts. Nevertheless, longer term local KIBS prospects remain uncertain given more recent losses in manufacturing and steel industry in the North East.

An alternative analysis of KIBS location patterns prior to the most recent economic crisis is presented in Appendix III. This analysis is based on the alternative source of data namely Interdepartmental Business Register (IDBR) and it covers the period 2000-2008. The analysis in Appendix III also represents some of the key sub-sectoral KIBS characteristics in terms of size and GVA. The next chapter is the methodology chapter which focuses on the author's own, independent survey of KIBS SMEs conducted in August 2010.

CHAPTER 4: RESEARCH STRATEGY

4.1 Introduction

While developing any particular research proposal strategy, researchers must decide what methodologies and methods will be used in their research and whether this choice is justifiable. The methodologies and methods should be suitable for the particular research question. The justification for any type of methodology and accompanying methods is often influenced by researchers' view of reality. It is closely entwined with the view and understanding about knowledge or how do we know something. In philosophy, a particular branch (epistemology) deals precisely with this problem. Epistemology is a way of understanding and explaining how we know what we know. Positivism, relativism, pragmatism and realism all represent philosophical basis which may influence researchers' views on science and truth.

This research aims to investigate location decisions of KIBS SMEs, their contribution to the economic base of the region both direct and through support to other sectors, their external knowledge sourcing practices and underlying knowledge bases as well as the relationships between external knowledge sources, absorptive capacity and KIBS innovativeness. This research also starts from the premise that these social phenomena exist in the world and not only in one's mind. In addition, it is believed that some reasonably stable relationships can be found among social phenomena. However, the social phenomena studied here are of a complex nature given that the research deals with people (firms) and their behaviour which are for the most part complex and dependent upon the complex social environment.

This chapter provides the review of the methodology of research adopted in the thesis and it is presented in several sections. First, the chapter begins by presenting a view on reality and knowledge. It proceeds by illustrating how research design and methodology were chosen. The chapter continues by presenting the choice of secondary data used in the analysis, sample design of the original survey and survey data collection procedure. It proceeds by outlining statistical procedures used in subsequent analysis (in the empirical chapters). The specific analysis techniques which are used to answer additional research questions are further presented in Chapters 5, 6 and 7, while the measurement of the key constructs and description of the variables used in the analysis is provided in this chapter.

4.2 Reality and Knowledge

Realism (an ontological[16] notion asserting that realities exist outside one's mind) is often taken to imply objectivism (an epistemological notion asserting that meaning exists in objects independent of any consciousness). Realist view is in line with a belief that it is possible to find fairly stable relationships between phenomena. Realist view is particularly evident in the model developed in Chapter 6 to account for KIBS SMEs innovation through external knowledge sourcing and absorptive capacity and the causal relationship which is tested in this chapter. Even though realist view is often associated with positivism it should be noted that positivist may differ in their approach.

Some positivists may claim that proposed hypotheses or research propositions may be verified by carefully constructed and carried out experiments while some may claim that they can only be falsified but not confirmed to be true. However, it should be acknowledged that this research deals with social phenomena and social phenomena are different to material things due to their complexity and intangible nature of social relations. It is worth noting that even though social phenomena are, for the most part, intangible or unobservable they exist and influence human and organizational activities because people construe them in common ways (Miles and Huberman, 1994). This view is in line with critical realism.

According to Van de Ven (2007) the following are key elements of critical realism:

[16] Ontology is a study of being. It is concerned with the nature of existence and with the structure of reality. It should be noted that ontological and epistemological issues often tend to merge together.

- There is a real world out there but individual understanding of it is limited. Social processes are more difficult to understand than physical, material things.
- All facts, observations and data are theory laden. There is no absolute or universal, error free truth in social sciences.
- No form of inquiry can be completely value free and impartial.
- Knowing a complex reality demands use of multiple perspectives and some methods are more suitable than others depending on the phenomenon to be studied.
- Robust knowledge is a product of theoretical and methodological triangulation and models that better fit the problem should be selected.

As Van de Ven (2007) notes, when conducting research observations become theory-dependent and the background knowledge held by an observer can influence, in major ways, what is observed. However, accepting that our accounts of the world are both bounded and perceptually laden does not make research invalid. When translating these concepts into research, it is possible to inquire into social phenomena (e.g. knowledge, networks), how they come about, and what their effects are. Specifically, this research investigates how these social phenomena are developed as well as what influence they have on organizational activities (Miles and Huberman, 1994) such as innovation. Having accepted that our perception of the phenomena under investigation is influenced by our prior knowledge and existing theories, and having asserted that there are no findings that can be labelled as absolutely true or certain we can build on existing theories and hope to produce new knowledge that can be expected to be meaningfully shared by other researchers.

4.3 Research Design

The research design is the plan for how the research will be conducted. As noted in the previous section the choice of research design is related to the researcher's view on social reality and knowledge. For instance, Burrell and Morgan (1985, 2) maintain that *"different ontology,* *epistemologies and models of human nature are likely to incline social scientists towards different methodologies".* This means that researchers will have a tendency to favour one research design over others. A choice of research design may not be solely inspired by any particular philosophical stance. It often comes about as a result of the demands of the inquiry and the information needed to answer the proposed research questions.

The research model relating to innovation and knowledge and propositions which were developed suggest causal relationships between variables. Causality implies one factor causing another. This can be addressed by a quantitative approach where "quantitative", refers to having many cases, applying formal measurements, and using statistical analysis (Davidsson, 2004). Quantitative data can be collected through surveys, experiments and secondary sources. For this study, both secondary sources and survey method was chosen over the experiment method, because of the complexity of the relations investigated. As noted by Bryman and Cramer (1999), many variables cannot be manipulated, which is the basic feature of experiments. Hence, their relationships with other variables can only be examined through a survey. A survey entails the collection of data on a number of variables from a large number of cases (Orum and Feagin, 1991). One aspect of quantitative research and surveys in particular is that researchers aim to make generalizable conclusions about the population beyond the survey sample. In this study, the "cases" surveyed are firms or rather, small and medium-sized KIBS firms. Indeed, the study's unit of analysis is the firm, and most theories which are used in this thesis to build research models are firm-level theories.

This research develops a number of research questions. These questions are then answered by analysing the results of the survey. Research questions which are answered in this thesis are related to the existing theory and prior empirical work. They are connected to three main themes this thesis is empirically investigating (KIBS contribution to regional success through their exports, support to other sectors and location; KIBS own innovation and its determinants and KIBS sectoral characteristics). Proposed research sub-questions are listed in subsequent Chapters 5, 6 and 7.

4.4 The Choice of Data

Data on KIBS regional employment patterns as well as employment data for other industries by the UK regions was gathered from secondary sources. The secondary data is used to set the scene and describe industrial profile of the two case study regions. This analysis is conducted in Chapter 3. Further analysis in Chapter 3 relates to characteristics of KIBS activity within the UK, regional and sub-regional level and to main themes (what sectors are involved, what percentage of regional employment is accounted for by KIBS, what are key trends and key players and time-series analysis of changes in KIBS employment).

The secondary data is available from the Office for National Statistics-Business Register Employment Survey (BRES) and covers period from 2009-2014. Employment estimates data is also used in Chapter 3 and it is related to the period 2008-2012. Interdepartmental Business Register (IDBR) data is used in Appendix III and covers the period from 2000-2008. As is explained by Davidsson (2004, 143): *"Secondary data are, to a large extent, as streetlights. They do illuminate some area s but they do not necessarily cast light on the issue you are interested in".* For example, the data for measuring some of the key variables in this study (e.g. variety of external knowledge) cannot be found in administrative and ONS sources.

The best alternative source of data which could have possibly been used in this thesis is the CIS which holds information on firms' innovation and various other variables. However, the CIS does not provide information on firms' location decisions, external knowledge sources by the detail required for the purposes of this analysis, financial information, sales information nor can the data be analysed by both sector and region. Another alternative source is Longitudinal Small Business Survey (LSBS). However, this survey does not allow (though in the future this may be possible) stratification of KIBS sub-sectors on a sub-national level. For all these reasons independent survey is justified.

To establish causal relationships in survey studies it is important to measure the cause before the effect (Menard, 2002). This calls for a longitudinal study, which involves collecting data on the causes before the data on the effects. Investigating the causal relationships set forth in the model developed in Chapter 6 becomes even more difficult with only cross-sectional data, i.e. data collected at the same point in time (Menard, 2002). Hence, this research is limited in this respect. It is worth noting that the measure of absorptive capacity as defined by investment in R&D does have a form of temporal effect as the data collected refers to years 2006 and 2009, whereas innovation relates to the past three years including year 2010.

Moreover, even in longitudinal studies it is difficult to establish the most appropriate temporal design, that is, to decide on the length of time between the different data collection points. Ultimately, this choice depends on the relationships to be tested. For the relationship between innovation and acquisition of new knowledge an attempt has been made to overcome the temporal difficulty by asking respondents to identify their external knowledge sourcing on average i.e. without relating their answers to any particular time period. With regards to R&D it was recorded for two points in time 2006 and 2009. The reasoning behind two time periods is twofold. First, it is reasonable to expect that the benefits accrued from investment in R&D can materialise quicker in smaller organisations, hence this information which was recorded for 2009 may capture that effect. Second, it is equally reasonable to expect that some firm success indicators such as innovation accrued from investment in R&D may equally occur over longer time span hence R&D information was recorded for 2006 and 2009.

4.5 Survey Design and Sample Source

When choosing appropriate sample both statistical and theoretical representativeness of the sample is important. The cases studied should be relevant for the theory which is tested. This research aims to investigate KIBS SMEs' location decisions, KIBS contribution to the economic base both direct and indirect, different knowledge bases in KIBS sub-sectors, relationships between external knowledge processes, absorptive capacity and firm innovation in KIBS SMEs in de-industrialised regions of North East and West Midlands in the UK.

Hence, the cases should comprise of KIBS SMEs which have engaged in external knowledge sourcing activities. The North East and the West Midlands provide suitable context for this study as they represent de-industrialised regions within the UK. However, in the North East and the West Midlands there are no comprehensive lists of SMEs which have engaged in external knowledge sourcing. Hence, it was not possible to strictly follow the guidelines to an ideal probability sample design, which would entail identifying a sampling frame of all KIBS SMEs in the North East and the West Midlands who engage in external knowledge sourcing and then selecting a random sample from that population.

The sample in this thesis was designed to be theoretically representative of KIBS SMEs in de-industrialised regions, and statistically representative of SMEs in two regions taken as whole. From the sample it is possible to identify nine KIBS sub-sectors/groups according to Standard Industrial Classification (SIC 2003) (computer and related; R&D; engineering; technical testing and analysis, architecture and urban planning; marketing research; management consultancy; advertising and publishing). The sample was not stratified according to sub-sectors but is fairly representative compared to the whole population in that respect (Table 4.1). The data was collected at one point in time through one survey instrument: a telephone interview in summer of 2010. The survey questionnaire is presented in Appendix IV.

The unit of analysis adopted in the survey is firm and the theories used are firm level theories of innovation, firm location, the economic base, differentiated knowledge bases, geography of innovation, absorptive capacity etc. The sample was chosen on the basis of statistical representativeness. Companies were identified using business database OneSource which is a proprietary source but it is available free of charge to PhD students from the British Library. The OneSource provides in-depth company profiles and also features industry and executives profiles, news articles, market research and analysts' reports. The OneSource enables three main search modes:

• Company: for searching for company reports which consist of a company profile, description of business activities, a financial snapshot and details of executive contacts.

• Industry: for searching for industry analysis, industry reports and profiles for over 100 major industries as well as market share and size statistics.

• Executives: for searching for key executives and board member by name, job function, line of business and company size.

For public companies and larger private companies OneSource database provides access to detailed broker reports and also provides coverage of the latest news stories, significant developments and strategic initiatives as well as SWOT analysis. The OneSource also includes financial information, executive and IT profiles, peer analysis and records of company fillings and competitors' reports. It provides coverage of blue chip companies for the emerging markets of Africa and Asia, market share and size reports for 100's of industries on a global and country by country basis. There is, however, limited financial information available for small and medium companies. However, the database was chosen due to its availability and satisfactory representativeness of SMEs compared to other data sources most of which also suffer from similar drawbacks.

The larger the sample size, the higher are the odds that answers truly reflect the population. This indicates that for a given confidence level, the larger the sample size, the smaller is confidence interval. However, the relationship is not linear (i.e., doubling the sample size does not halve the confidence interval). The decision about sample size should be based on factors such as: time available, budget and necessary degree of precision. The KIBS sample in this thesis comprises of 342 companies. A sample of 342 (it should be noted that there is missing industry information for one firm) companies in both regions allows for the geographical representativeness criteria to be met for the two regions taken together. This decision, however involves a degree of compromise between the statistical accuracy and the potential costs incurred by doing extra interviews. For instance, the total number of technological and non-technological KIBS SMEs in the North East and the West Midlands as per

Interdepartmental Business Register in 2010 was 31,495. The sample required at 95% confidence level to achieve 5% precision level would be 380. To achieve 6% precision level for the same sample, only 265 interviews are required.

The 342 interviews completed achieve the precision level of 5.27% at the significant cost reduction. Precision level of 5.27% is taken to be adequate for this type of research. According to the Interdepartmental Business Register, total KIBS population as defined in this study in 2010 is 31,495 firms for both regions. Assuming no sample bias, if for example 50% of survey participants report exports outside the region or innovation then the actual population which exports outside the region or innovates could vary by +_5.27%. In other words we can be 95% certain that the actual population that trades outside the region or innovates can be as low as 44.73% (50-5.27) as well as high as 55.27% (50+5.27). It should be noted that for proportions larger or smaller than 50% the CI will be smaller. It should also be noted that analysis in Chapters 5, 6 and 7 is based on smaller samples. In Chapter 5 the sample is reduced because a number of firms did not provide answers to questions related to their source of revenue. Hence, some analysis on companies' revenue in Chapter 5 is based on 257 usable responses, representing a 6.09 confidence interval (margin of error) at 95% confidence level.

For the other type of analysis on revenue by type of customer in Chapter 5 the number of observations is down to 225 and the corresponding CI is +_6.51%. However, this is still within the acceptable limits for a survey research (see for example Oerlemans et al., 2006). Regression analysis performed in Chapter 6 is based on 296 observations. Reduced samples in these two chapters are due to a number of non-responses related to questions on innovation and external knowledge sourcing. However, in Chapter 5 respondents to revenue questions were compared to non-respondents to check for potential non response bias with regards to size, age and industry. No significant differences were noted between respondents and non-respondents.

The telephone survey was conducted using CATI (Computer Assisted Telephone Interviews). Telephone survey research has over the years become one of the most commonly used means of collecting survey data. Today much of it is done by CATI systems in which the interviewer follows a script shown on the computer screen. As a result, skip patterns in the survey and item grid rotations can be easily incorporated into the survey research program. These techniques reflect good survey methodology and are unavailable with mail or on-site methodologies. Using the telephone methodology, phone number lists are fed into a CATI system. Interviewers are assigned a firm, the computer dials the number automatically, and the survey is administered as a script printed on the screen. As the firm owner/manager answers questions, the interviewer records the responses on the computer. Logic within the program then selects the next appropriate question to be read to the respondent.

A CATI-trained interviewer can easily move from the survey to the explanation and back in a conversational manner. As a result, there is a good opportunity for respondent comprehension and hence better information, and less opportunity for data contamination as a result of "leading the respondent," accidentally, in the process of trying to explain a term or concept.

There are many advantages of CATI surveys. Some are listed below.

- People can usually be contacted faster over the telephone than with other methods. If the Interviewers are using CATI, the results can be available minutes after completing the last interview.
- CATI software, such as The Survey System, makes complex questionnaires practical by offering many logic options. It can automatically skip questions, perform calculations and modify questions based on the answers to earlier questions. It can check the logical consistency of answers and can present questions or answers choices in a random order.
- Skilled interviewers can often elicit longer or more complete answers than people will give on their own to mail or email surveys. Interviewers can also ask for clarification of unclear responses.

- Some software, such as The Survey System, can combine survey answers with pre-existing information about the people being interviewed.

One disadvantage of CATI is high cost. By outsourcing the survey to an agency with in-house call centre achieves speed and desired response rate given a large number of involved interviewers. The cost may still be high, but speed, accuracy and response rate remain uncompromised.

An alternative method to gather the data would be mail survey. However, after careful consideration it seems that there are too many disadvantages in conducting a mail survey. The following apply:

- Mail surveys take longer than other kinds. There is a need to wait several weeks or even months after mailing out questionnaires before we can be sure that all firms that intended to answer the questionnaire have actually done so.
- Mail surveys are usually perceived as cheap. However, to obtain responses from a sample of 300 firms, and if the common 10% response level is taken into account, 3,000 questionnaires have to be mailed out. The costs of printing 3,000 questionnaires as well as costs of stamps and self-addressed envelopes should not be underestimated.
- Response rates in mail surveys tend to be lower than in telephone surveys. One way to increase responses in mail surveys is to use an incentive. Another possibility is to include people who return completed surveys in a drawing for a prize. A third is to offer a copy of the (non-confidential) result highlights to those who complete the questionnaire. Any of these techniques will increase the response rates but costs as well.

It is appropriate to point out that the researcher was not involved in data collection. Data collection was outsourced to an external marketing research agency. The survey was sponsored by the National Endowment for Science Technology and Arts (NESTA) who also partially sponsored the whole PhD project. However, the researcher designed the questionnaire, led and designed data collection as well as sampling and stratification strategy. More information on the construction of the original sample is provided below which includes sample development, the response rates, and the survey instrument. Having a survey conducted by a professional agency improved the quality and speed. Anecdotal evidence shows that PhD students conducting their surveys alone end up with incomplete samples. Incomplete sampling has detrimental negative effect on the quality of analysis resulting in problems with generalisability, reliability and validity of findings.

4.6 The Construction of the Original Sample

Two individual samples for the North East and the West Midlands were identified according to standard industrial classification definition of KIBS (as explained in the introductory chapter) and size (small and medium firms only with 1-249 employees). Contacts were drawn from the OneSource database. Small and medium-sized enterprises were defined in terms of number of employees: 10-49 employees for small-sized firms and 50-249 employees for medium-sized firms (which are the European Union’s cut-off for small and medium-sized enterprises, respectively). The businesses’ industrial sectors were defined and framed according to the Standard Industrial Classification (SIC 2003). The sampling frame was originally planned to be stratified using two criteria in order to meet the survey requirement of a diverse sample with analysable sub-groups.

The stratifying criteria were intended to be applied to both North East and West Midlands individually and were to include:

- Employment size class, divided into two groups: 10-49, 50-249.
- Industrial sector, divided into nine groups: computer and related; R&D; engineering; technical testing and analysis; architecture and urban planning; marketing research; management consultancy; advertising and publishing. The sampling frame would have been divided into 18 strata (9 industrial sectors * 2 size). However, stratification model was abandoned since the contacts in the North East were exhausted. In other words, even if the attempt had been made to obtain a stratified sample in North East, it would almost certainly be comprised of the same respondents. The West

Midlands contacts were stratified into three geographical regions and random samples were drawn from these.

4.7 Sample Development and Data Collection

In summer 2010, 342 firms comprising the original sample were interviewed over the telephone. Out of the original 888 contacts in the North East, valid responses were obtained from 167 firms. For the West Midlands, 175 valid responses were collected. Reasons for non-response in North East are known:

From a total of 888 contact records, 68 did not have a telephone number shown. The outcome of the calls to the 820 companies with a telephone number shown was as follows:

Interviews completed	167
Interviews refused	293
Number not in service/wrong number	87
Duplicate records	2
Inappropriate company (no longer trading, not based in the North East etc.)	71
No contact despite repeated attempts (at least 6 attempts, sometimes more)	200

The data collection in the North East initially has been very slow because of a high refusal rate (it was averaging about 5 refusals to every interview). Also, the need to preserve as much randomness in the achieved sample as possible required making several (in this case at least 6) attempts before giving up on the contact. Survey research projects usually start quite slowly because of the "pipeline effect" due to waiting for 6 attempts to be completed before moving on to the next contact. Eventually the pipeline has been filled and the interviewing commenced at a faster rate. The ratio of interviews to refusals was high (over 1 in 3 of those with whom contact was made completed an interview).

For the West Midlands, contacts were stratified as follows:

- Herefordshire, Shropshire and Staffordshire (total contacts -800);

- Rest of the West Midlands excluding Birmingham and surrounding areas (total contacts-800);
- Birmingham and surrounding areas (1300 contacts).

160 planned interviews for the West Midlands have been divided into: 44 for Herefordshire, Shropshire and Staffordshire; 44 for the Rest of West Midlands excluding Birmingham; 72 for Birmingham, with a random sample defined for each of the three (combinations of) regions. The sample was later enhanced by additional 15 interviews from larger companies. The random sample was obtained by putting the contacts for each of Herefordshire/Staffordshire/Shropshire, Worcestershire/Warwickshire and Birmingham area in random order and then proceeding down the list until an "outcome" had been achieved.

An "outcome" was defined as a completed interview, a refusal or six unsuccessful attempts to make contact. This procedure continued until the target number of interviews for each sub-area was completed. This approach produced a somewhat skewed sample where larger companies (in terms of number of employees) were most likely to refuse the interview or to be difficult to contact. Fifteen additional interviews were added concentrating on the larger companies in order to make the achieved sample more representative of the universe from which it was drawn.

The targeted respondent was the owner or CEO. This choice was made in the light of the key role played by the CEO in SMEs (Wiklund, 1998). In smaller firms, chief executives are directly involved in the business and have first-hand information on what is going on in the firm. The telephone interview gathered information on whether the person answering the survey was a manager or owner/CEO.

4.8 Response Rate and Sample Representativeness

A response rate is calculated by dividing the number of cases that responded by the number of cases selected for the study. Number of cases selected for the North East was 888 and for the West Midlands it was 2900. It is only plausible to calculate the response rate for the North East since the West Midlands responses were targeted at 175 and all 175 responses were obtained. 167 usable responses were received for the North East representing a response rate of 19%. This is somewhat higher compared to other surveys of the general SME population in the UK which is between 12%-15% (see for example Brooksbank et al., 2001).

Volatility is a well-documented problem for SME research (see for example Storey, 1999). Firms may have simply moved, become part of a larger organisation, or have grown above the limit of 249 employees organically. A significant proportion of recorded non-response is therefore due to failing to reach valid targets as shown above for the North East sample. Hence, taking into consideration that a vast number of contacts were unusable and after deducting those from the total number of targeted responses, the adjusted response rate for the North East is in fact 36%, which is exceptionally high.

Overall the data is broadly representative of KIBS SMEs in the North East and the West Midlands. In particular, there was no evidence that more "successful" firms replied to the survey. The respondents report a range of both negative and positive growth and innovation outcomes, broadly reflecting a population of KIBS sub-sectors (Table 4.1).

Table 4.1 Sample representativeness by KIBS sub-sector

	Number of firms-total	**%**	**Number of firms-sample**	**%**	**Sample representativeness**
Computer and related	9130	**29**	106	**31**	**1**
R&D	370	**1**	10	**3**	**3**
Management consultancy	10755	**34**	112	**33**	**1**
Architecture, urban planning, engineering and technical testing	8905	**28**	83	**24**	**1**
Advertising and market research	1495	**5**	14	**4**	**1**
Publishing	840	**3**	16	**5**	**2**
Total	31495	100	341	100	1

Note: The source for the total population is Interdepartmental Business Register (IDBR), 2010.

It should be noted, however, that R&D is relatively over represented in the survey whereas advertising and market research sector is slightly under-represented.

Table 4.2 shows some of the main sample characteristics. It should be noted that the sample size mean is 12 and firm vintage mean is 17. There are more non-innovators than innovators in each category (product/service; process and marketing innovation). There are 13% of firms who have income from property rights.

Table 4.2 Sample characteristics

	Mean	Number	Valid Percentage %
Company size (mean)	12		
Company age (mean)	17		
KIBS located in city		93	27
KIBS located in town, village or countryside		249	73
Product/service innovators		150	44
Product/service non-innovators		190	56
Process innovators		110	32
Process non-innovators		229	68
Marketing innovators		130	38
Marketing non-innovators		209	62
KIBS who have income from property rights		44	13
Technology KIBS-T KIBS		199	58
Professional KIBS-P KIBS		142	42

As mentioned already, the data were collected from the respondents through just one survey instrument: the telephone interview. The initial version of the questionnaire was pre-tested on a convenience sample of five firms. After pre-testing, the questionnaire was refined, e.g. some question items were excluded from the questionnaires and the phrasing of other question items was changed.

4.9 Defining Research Variables

In order to answer research questions it is necessary to develop measurement of the constituent concepts. This process is called operationalisation of constructs. The process entails the translation of concepts into variables. In this research variables used are explained below.

Firm Characteristics

The first section of the questionnaire investigates the demographic characteristics of enterprises. Respondents were asked in which year was their business established, to describe their main business activity, to state current number of employees and to state their business location be it a city, town, village or countryside. These variables are used as control variables in regression analysis in Chapter 6 but also to answer research questions in Chapters 5 and 7 which relate to the extent of firms' market extension in Chapter 5 and to differentiate between KIBS sub-sectors in Chapter 7.

Firm Location Decision Variables and Source of Revenue Variables by Type and Location

The second section of the questionnaire investigates firms' location decisions with the purpose of establishing to what extent localisation economies or perhaps some other theory better support understanding of KIBS SMEs location in de-industrialised regions. This section also investigates revenue earned by KIBS SMEs by the type of customer and by customer location. These variables are used in Chapter 5 which aims to establish KIBS' role in regional economic success by assessing their potential for market extension, both extra regional or UK wide as well as internationally.

Second, they are used to establish the extent to which KIBS in de-industrialised regions depend on other sectors and more precisely to what extent are they dependent on the industrial base of these regions and to what extent are they developing as independent drivers of economic base of regions. It is assumed that if KIBS depend on regional manufacturing and consumer demand their direct role in regional development is relatively limited but nevertheless they may provide valuable support to the existing manufacturing base or indeed other services or public sector.

Location decision variables are measured on a 10 point Likert scale where particular location choices are rated from1 to 10 where 1 is not important and 10 is very important. These location choices were classified into: proximity to customers; proximity to suppliers; availability of local professional/skilled staff; proximity to other firms in the same industry; availability of local, informal networks; good international connectivity; low cost of support staff/premises/business rates; proximity to owner's/manager's home; good quality of life.

The revenue variables are expressed in terms of percentages of the revenue earned by the type and geography of sources (namely, regional manufacturing; national manufacturing; international manufacturing; regional services; national services; international services; regional consumers; national consumers; international consumers; universities and domestic public procurements). In Chapter 5 the analysis is based on derived revenue variables. First, reported revenue percentages were converted into continuous variables using the information from the survey related to the total revenue reported by firms and dividing this figure by the percentages (reported for each of the above category). Second, the variable which is measured in nominal terms is constructed taking a value 1 if a firm reported revenue outside its region and value 0 otherwise. Third, the variable "exports" is constructed which takes a value 1 if a firm has revenue from exports and value zero if not.

Financial Information Variables and Innovation Variables

The third section of the questionnaire investigates firms' financial information such as turnover, share of exports in sales, R&D to sales ratio, annual profits and different types of innovation. The financial variables are measured on interval scale. Innovation variables are nominal and take the value 1 if a firm introduced product, process, organisational and marketing innovation in the past three years and the value 0 if not. These variables are used in chapter 6 which investigates the determinants of innovation. It should be noted that R&D variable is recoded in some of the analysis to capture different levels of R&D activity, namely greater than 10%, 5-10% and less than 5% of the total turnover. An alternative dummy variable is also used in the analysis in Chapters 6 and 7, which takes the value 1 if the firm invests in R&D and the value 0 if it doesn't.

External and Internal Knowledge Source Variables

The fourth section of the questionnaire examines different types of knowledge sources for KIBS by the type and geography of these sources. It also asks firms to state the type of internal knowledge utilised. All variables in this section are measured on a 10 point Likert scale whereby 1 means not frequently utilised and 10 means very frequently utilised. External knowledge sources were classified into: customers; suppliers; rival firms; employment; licences; consultants; formal strategic alliances/joint ventures; public sector organisations (such as private training or research providers and consultants); literature/patents; conferences/trade fairs/exhibitions; professional and trade organisations; universities and other higher education institutes; contract research; research cooperation; business networks and informal contacts. All variables are further classified into: regional, UK wide and international. External knowledge sources variables are used in regression analysis in Chapter 6 in order to tackle research questions related to their role in enhancing innovation capability of KIBS. These variables are reduced by Factor analysis and 13 new external knowledge variables were created. These new variables are described in detail in Chapter 6. External sources of knowledge variables are also used in Chapter 7 where several new variables were created by constructing ratios of analytic to synthetic knowledge and the ratio of international to regional knowledge.

Barriers to Firms Success Variables

The last section of the questionnaire investigates barriers to firms' success. Demand side barriers are used in Chapter 5 to test to what extent are KIBS in the two de-industrialised regions disadvantaged and to what extent they face competition from competitors located elsewhere. These variables are also measured on a 10 point Likert scale and include: long distance to main markets; problems recruiting skilled workforce locally; the extent of inability to access markets outside the region; increased competition faced from companies which are located outside the region; limited opportunities for networking and exchange of information in the geographic location (city, town, village); insufficient quality of knowledge held by others in the region; the cost of sourcing knowledge held by others in the region; the cost of sourcing knowledge from external sources.

4.10 Short Introduction to the Choice of Analysis

Quantitative methods generally require prior analytical and theoretical frameworks before collecting data whereas qualitative studies, if informed by the logic of grounded theory (Glaser and Strauss, 1967), develop frameworks/theories before, during and after the data collection process. In this study, existing theories in relation to firm location, economic base, knowledge bases and geography of innovation were identified prior to data collection. To test these theories and their relative importance, research questions were drawn and these are subsequently answered using the data gathered by the survey. Alternative qualitative research methods could have been adopted in the thesis. However, the nature of the inquiry as adopted in the thesis calls for a quantitative method.

This is not to suggest that one method should be chosen over another, rather that quantitative analysis is appropriate for identifying common patterns and themes and causal relationships between variables. Qualitative analysis is more suitable for identifying why particular patterns occur. The primary aim of the thesis and the purpose of the KIBS survey in the North East and the West Midlands are to identify main patterns of location decisions, knowledge sourcing practices, market extension, knowledge bases and determinants of innovation in KIBS SMEs, hence the survey method proves superior to case study method. The purpose of the secondary data as obtained from the Office for National Statistics is to establish KIBS and other industries location patterns across the UK (Chapter 3).

Statistical analysis of the data generated from the survey takes the form of both descriptive, bivariate and regression techniques. More precisely analysis includes cross-tabs with statistical significance tests (T-Test, Chi-square and one way ANOVA), correlation analysis (Pearson and Spearman correlation statistics), factor analysis and regression analysis, more precisely logistic and probit regression methods. Correlations utilise the most appropriate statistic (pearsons, spearman or tau) for the data type in question (i.e. nominal, ordinal, or continuous), with significance tests undertaken at the 5% and 1% levels. Where applicable, difference of means tests was also used.

Regression analysis represents a family of techniques which can be used to test the causal relationships. Logistic and probit regression analysis techniques tend to be less sensitive than other techniques to departures from normality in the independent variables and allows the dependent variable to take either nominal or ordinal form (ordered logistic or probit regression). As many variables in this sample are not normally distributed it follows that the logistic and probit regression is most suitable.

Regression models relating KIBS SMEs innovation to external knowledge sources and absorptive capacity (R&D) are developed. The dependent variable takes a value of one if the firm introduced new or significantly improved product, service, process, organisational innovation and marketing innovation and the value zero if not. Linear regression is not appropriate instrument as the dependent variable in this case is binary and not continuous. Linear regression was used in Chapter 7 where a continuous variable (ratio of synthetic knowledge to analytic knowledge) was used as the dependent variable in the model.

Confirmatory factor analysis (CFA) is also used to provide a confirmatory test of the measured variables which are used in the analysis as well as to reduce the number of external knowledge sourcing variables and identify meaningful relationship patterns between independent variables. Another benefit of conducting CFA is to avoid problems of co-linearity in regression analysis by reducing a number of highly correlated independent variables. CFA variables (13 new factors) were constructed and used in Chapter 6. CFA was also useful in aiding *discriminant validity*. This is the extent to which a construct is distinct or unique and captures phenomena that other measures do not. Hair et al. (2007) suggest testing for this by looking at the square of the correlation estimate between two constructs. Correlation statistics has indeed shown that many of the external knowledge variables are highly correlated hence the CFA technique was introduced to overcome this problem.

Face and nomological validity, however, constructs the theoretical justification of using particular scale items and assesses the extent to which the constructs correlate with each other, as predicted by theory. To comply with *face validity*, the constructs were used to comply with those previously used in the literature on innovation and co-operation. With regards to *nomological validity*, the correlation matrix in Chapter 6 reveals significant and positive relationship with many of the co-operative constructs and innovation constructs as theory would suggest (see Table 6.2). Therefore, the measures employed in the study appear to be valid and appropriate.

It should also be noted that initial exploration of variables showed that most do not satisfy criteria necessary for the use of parametric tests. In other words most variables <u>did not</u> satisfy the following three conditions:

- The variables are measured with an equal interval ratio scale
- Variables' variances are equal or homogeneous
- Variables have normal distribution

Hence, non-parametric techniques were used since unlike parametric tests, non-parametric test can be applied to data measured on ordinal and nominal scale and categorical variables alike. In this survey most data captured are measured on nominal, categorical and ordinal scales are not normally distributed.

4.11 Conclusion

This chapter defined the methodological framework and discussed how concepts, variables and models for this particular line of research inquiry were created. This chapter has also described data collection method, sample construction and representativeness as well as some of the main characteristics of the sample. The particular survey methodology and subsequent analysis is shown to meet the specific objectives of this study. In other words it can be concluded that objectives of the study require collection of the quantitative data. In order to gather data computer aided telephone interviews were proved to be most effective. Regarding data analysis two statistical packages were used namely SPSS and STATA. Preliminary analysis showed that majority of variables violated assumptions required for the parametric analysis hence non-parametric analysis was used in most cases.

Subsequent data analysis in Chapters 5, 6 and 7 provides description of constructs and variables, their operationalisation and validation. Validation will be explained with reference to other studies which use similar constructs as well as how validation of some constructs is attempted by performing Factor analysis.

CHAPTER 5: KIBS STRUCTURAL ROLE

5.1 Introduction

This chapter is concerned with the KIBS structural role. The main research question this chapter aims to answer is: **To what extent do KIBS depend on the industrial structure of their regions and to what extent are they tradable across space?** The main themes investigated in this chapter are: (i) The contribution of KIBS SMEs to their regional economies by generating exports from other regions in the UK and internationally (ii) KIBS Support to specific sectors within and outside their respective regions (the role of intermediate demand) and (iii) KIBS location/decentralisation. These three themes comprise the conceptual framework adopted in this chapter. While the observations and the data are related to the UK and are based on the primary survey of KIBS SMEs, the results still exhibit a degree of generalisability to other regions, which may also be characterised as de-industrialised.

Geographers and regional scientists emphasise that trade in services is largely defined by central place hierarchy position of metropolitan places (such as New York, London and Tokyo), while others have argued for the substituting role of services in place of primary sectors such as manufacturing (Beyers and Alvine, 1985). Nevertheless, there has been a dearth of research related to the structural role of KIBS activities in non-metropolitan regions (Wood, 2010) and in particular to the role of intermediate demand in KIBS localisation (Meliciani and Savona, 2014). This is surprising as these intermediate functions originally sparked interest in KIBS, based on their remarkable employment growth from the 1980s at a time of structural change associated with de-industrialisation (see for example Marshall, 1985; Wood, 1986).

And while most KIBS research focuses on tradable and elite corporate functions located in core, metropolitan regions, this chapter seeks to investigate the structural role that KIBS SMEs play in de-industrialised regions. It is argued that the sectoral composition of regional economies and inter-sectoral linkages are important determinants of regional specialisation in KIBS. If KIBS in de-industrialised regions depend mostly on manufacturing clients, further de-industrialisation may pose challenges for their future survival and regional policies could be devised with the aim of supporting technological upgrading of related industries (Asheim et al., 2011).

In this case such policies will be based on technological upgrading of industries which have roots in old industrial formations. If, however, KIBS in de-industrialised regions depend largely on other services, there is a scope for devising separate, service oriented policies (Rubalcaba, 2006). For those KIBS which largely depend on consumer demand and government contracts, prospects may be more uncertain. The demand for these KIBS may fluctuate in line with economic cycles and government policies.

The results from the combined West Midlands and North East survey[17] show that although KIBS play important role in the local economic base of de-industrialised regions they are not as important as elite, tradable KIBS in global cities such as London. This is because only a proportion of these KIBS export internationally. However, most KIBS SMEs in the North East and the West Midlands provide important, mostly indirect support to their regional clients. Hence, most of these KIBS can be classified as "indirectly basic".

Important sub-sectoral differences indicate that some KIBS are more dependent on the existing industrial profile of their respective regions than others. It is such KIBS that may benefit from the demand side regional innovation policies based on supporting old industrial formations. Majority of KIBS, however, depend on other services, a finding which indicates that there is a scope for service-centred policies to promote regional

[17]The analysis in this chapter provides combined results for the two case study regions. The survey data (Appendix I) shows that there are no significant differences between the two regions with regards to KIBS tradability outside their respective regions but the West Midlands KIBS are more likely to be exporters. However, the scale of this difference is rather small.

The results for different KIBS sub-sectors were also compared between the North East and the West Midlands and no statistically significant differences were noted with respect to either extra regional sales or exporting.

development. Most KIBS gain revenue from other regions and are mostly home grown businesses. However, there is some scope for attracting new KIBS to these regions as long as they can benefit from good local amenities and lower business rents.

The chapter proceeds with the assessment of the direct and indirect contribution KIBS make to their regional economies. This is followed by existing empirical evidence related to KIBS tradability, the role of intermediate demand and location. Proposed research sub-questions are answered using evidence from the North East and the West Midlands survey in relation to KIBS market extension, their support for other sectors as well as location and some region specific constraints. The discussion and conclusions provide implications for regional development policy.

5.2 The Conceptual Framework

The conceptual framework adopted in this chapter considers the role of KIBS in regional development through their own exporting potential, their potential to decentralise (location) and their role in supporting local sectors (intermediate demand).

Export Base Model

The Export base model emphasises an important role for external demand in determining region's growth. In its simplest form the main argument underlying export base theory is that if there are favourable conditions for export growth such as desirable price of region's exports, high income levels in other regions and relatively high prices of substitute goods, the stimulus of export demand will have a multiplier [18]effect on

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[18]**Application of the Multiplier**

Suppose that the marginal propensity to consume in some economy is 0.8 and that all of this consumption is met by domestic production, so that m=0. Then the multiplier, $\frac{1}{1-c+m}$, is 5. This means that for every extra Pound of exports, regional output rises by 5 Pounds. The idea basically is this: the “first round” of the extra Pound in exports raises Y by £1. This extra income then creates a “second round” of consumption expenditure of £1x0.8=£0.8. This in turn creates a “third round of expenditure equal to £0.8x0.8=£0.64; and so on. When these “rounds” get added up, they result in a total increase in Y of £5.

regional income. The potential role of regions' exports in explaining growth was first emphasised by economic historians (see for example North, 1955)[19].

The Export base model (or Economic base theory) divides sectors into basic and non-basic. North (1955) and Tiebout (1956), in their famous exchange, argued that service sector growth depends on the growth of the basic sectors such as manufacturing, agriculture and natural resources extraction. Researchers have long thought of services as non-basic or non-tradable and noted that many services require, or seem to require, face-to-face interaction (Jensen, 2013). More recent literature on international tradability of business services shows that improved communication and transport, in the past several decades, allowed exporting of services via various channels such as joint ventures, FDI and partnerships (Daniels, 1993; O'Farrell and Wood, 1994; O'Farrell et al., 1995; Miozzo and Miles, 2003).

Flows of exports, however, do not automatically create an important multiplier effect in the local economy if the export revenue is not injected/spent in the local economy (Armstrong and Taylor, 2002). As noted in Chapter 2, in relation to the example of branch plants and their headquarters, an activity, firm or industry can have a high export activity but rather weak local effect unless this revenue is spent within a region. It can also have a low export activity but high local effect or local links. And while it is difficult to establish the extent to which services are exported on a regional level with high level of precision, evidence points to the productivity-enhancing role of KIBS serving as inputs to other industries within their localities.

In this example, the region has what might be called strong internal linkages. All consumption is directed to local products; at the margin, no consumption goods are imported. The smaller the region and the less developed it is, the less realistic is this assumption.

[19] These explanations were largely developed in relation to the resource rich regions in the US. It was argued that capital and labour would flood to such regions to exploit natural resources. The central idea is that initial growth can be traced to growth of the basic or export sectors of the local economy, which assumed agriculture, natural resources and manufacturing (North, 1955; Tiebout, 1956).

The Role of Intermediate Demand

According to Beyers (1990), even though KIBS may export less than manufacturing firms they are generally characterised by closer links with the local customer base. It follows that even if KIBS have a lower exporting activity compared to manufacturing they may still create an equivalent or even higher impact due to the contribution they make to the productivity and competitiveness of local firms (Moyart, 2005, 217). It is believed that certain technical KIBS provide research, development, engineering and design essential for creating goods and processes (Glasmeier and Howland, 1993). Professional KIBS (for example consulting) identify markets and problems associated with running and conducting business. However, there is still a gap in our understanding how specifically KIBS contribute to the efficiency of other firms (O'Farrell and Hitchens, 1990) and this topic is outside the scope of this research. Nevertheless, it would not be possible to comprehend this local efficiency enhancing role KIBS play without knowing first what markets they serve.

The traditional view of services is that the output is sold either to local residents or households or local manufacturing and therefore embodied in local manufacturing exports. If KIBS largely depend on manufacturing this carries important policy implications as regional support should be directed towards manufacturing rather than KIBS (Coffey and McRae, 1989). This view implies that KIBS will share the benefits of manufacturing expansion and exporting through their input ties to manufacturing firms. If KIBS are depending on local households they are not a suitable base for regional development as their existence is merely a reflection of local incomes and wealth.

Wood (2010) argues that majority of European micro-level studies overemphasise business service contribution to manufacturing (see for example, Koch and Stahlecker, 2006; Aslesen and Isaksen, 2007; Corrocher et al, 2009; Toivonen and Tuominen, 2009). This is surprising as evidence shows that it is other service firms, which constitute the most important market for KIBS (Marshall et al., 1988; Harrington, 1992). More recently, a stream of literature developed which concentrates on establishing the economic performance of manufacturing industries to the extent and quality of their linkages to KIBS (see for example Camacho and Rodriguez, 2007a, 2007b; Evangelista et al., 2013; Evangelista et al., 2015). Other studies, however, deal with KIBS entrepreneurship investigating their specialist client portfolio and emphasising the role of multi-national enterprises in aiding KIBS entrepreneurship and development (see for example Jacobs et al., 2013; Jacobs et al., 2014) but there is a dearth of recent research which aims to understand the role of KIBS in de-industrialised regions through careful consideration of the markets and industries they serve.

KIBS Location

In the geography literature KIBS are mostly associated with urbanisation economies (see Chapter 2 for a review of KIBS location theories). However, recent literature suggests that professional, technical and scientific services are usually associated with localisation economies, whereas finance, insurance, real estate and leasing are seen to benefit from the general advantages accruing from large urban areas (Wernerheim and Sharpe, 2003). However, Wood et al. (1993), in their case study of computer services and business consultancies in the UK, found no evidence of firms' backward linkages (i.e. linkages to suppliers) or of economies of localisation (i.e. linkages to firms in a similar line of business). It follows that agglomeration economies, be it urbanisation or localisation economies, may not be the best model for explaining KIBS location in non-metropolitan regions. It also follows that more attention should be directed towards examining the role of intermediate demand (i.e. linkages to industry epitomised in pre-existing industrial structure of regions).

However, if KIBS in peripheral regions depend largely on pre-existing industrial structure they may be particularly disadvantaged by less sophisticated demand compared to their metropolitan counterparts. Another disadvantage may come about as a result of declining client base given that employment in manufacturing has generally been decreasing in all types of regions (see chapter 3). O'Farrell's (1993) analysis of business service providers in Canada's periphery province of Nova Scotia shows that small KIBS can hardly be an engine of growth as they depend largely on government contracts and public sector demand.

In addition, the prospects for peripheral regions can hardly be enhanced by local KIBS exportability while lack of social attractions or poorly developed infrastructure still persist (Wood, 1986). Empirical evidence (see Appendix III) shows that KIBS employment growth outside London did occur between 2000 and 2008. Nevertheless, this trend mostly took form of de-concentration into attractive and amenities rich, adjacent suburban counties and areas within the South East, rather than dispersion away from London and the South East.

5.3 Existing Empirical Studies

5.3.1 KIBS Tradability-Sectoral Differences

A number of studies investigate tradability of different KIBS sub-sectors. According to Riddle (1986), consulting, banking, insurance and data processing are traded most widely. Van Dinteren (1987) found that in Netherlands, accounting, legal services and engineering are also widely traded. UK scholars (see for example Daniels, 1985; Marshall et al., 1988) argued that corporate services and in particular management, computer services and advertising are exported more than commonly perceived. In Europe, Illeris (1989) shows that, compared to accounting and personnel services, marketing services are more exportable across distance. Noyelle and Stanback (1984) and Beyers and Alvine (1985) argued that advanced services are exported either directly as a final "product" or, more often, indirectly as intermediate services. Some uncertainty, however, still exists as to what proportion of these services is traded outside the region (Glasmier and Howland, 1993, 210). Hence, first research sub-question this chapter aims to answer is:

1. **Do any particular KIBS sub-sectors have a higher propensity to export outside their regions than others?**

5.3.2 KIBS Tradability-Evidence from Different Regions

O'Farrell et al. (1995) argue that international as well as inter-regional trade in financial and business services has become an important component of contemporary regional growth and economic differentiation in the UK. O'Farrell et al. (1996) showed that in Britain, producer services contributed to the export base but provided somewhat gloomy picture for peripheral regions. This study showed that London dominated with regards to the provision and trade in producer services. Concentration of KIBS in London and the South East from the early 1980s and onwards resulted in commercial and trading dominance of London at the expense of the rest of the UK (O'Farrell et al., 1995). It has been argued that peripheral regions have become increasingly dependent on business services skills imported from the core regions (Howells and Green, 1986; Marshall, 1988).

Previous empirical studies in the UK showed that only a minority of KIBS SMEs located in more peripheral regions are active in national and international markets often reflecting long established regional expertise, e.g. in engineering, design and logistics and more recently in IT and software, often stimulated by the competitiveness of their clients (see for example O'Farrell et al., 1993; Beyers and Alvine, 1985; O'Farrell et al., 1996; O'Farrell et al., 1998).

However, the US and Canadian evidence shows that services are exported from more peripheral places such as towns and smaller cities. In 1982, Polese identified a significant interregional trade activity in the rural area of Quebec. The evidence from 480 firms from Quebec (excluding Montreal) and the rest of Canada (excluding Toronto) suggests that services are exported from small and intermediate urban places. Smith and Pulver (1981) show that services located in rural Wisconsin (US) do engage in exporting. However, exporting depends on the type of ownership and size of the firm. This finding was largely confirmed by Beyers (1991) who argued that firms in core regions and larger firms mostly engage in inter-regional trade.

Stabler and Howe (1988) note that services exports were a significant contributor towards economic growth of four Western Canadian provinces during the 1970s. Birch (1987) studied new service firms in

Minnesota and found that producer services in particular had even higher sales outside the state compared to manufacturing firms. Porterfield and Pulver (1991) surveyed service firms in the upper Midwest region of the US. Their results show that service providers exported 16.7% of sales out of their state. In their earlier study, Beyers and Alvine (1985) showed that 1,100 firms in Puget Sound exported at least 10% of their services. Firms in their sample recorded sales to other American states but also to Canada, Asia, Europe and Latin America. Beyers et al. (1985) found that in Central Puget Sound Region producer service firms exported some 36% of their business outside of the region. It was also shown that the structure of service economy in Central Puget Region was similar to other metropolitan US areas.

Some researchers contribute to the location theory of KIBS by examining the level of service activity at various locations (see for example Coffey and Polese, 1987; Wernerheim and Sharpe, 2002). This research largely adopts ideas from the Christaller's central place theory. A number of studies show that KIBS exports do not necessarily align with the central place theory, which postulates the division into higher and lower order services trade. This is because It is evident that KIBS from smaller centers also engage in extra regional and international trade (see for example, Beyers and Alvine, 1985; Coffey and Polese, 1987; Stabler and Howe, 1988; Illeris, 1994).

A number of more recent studies also show that KIBS may develop relationships beyond the local context at the national level (Strambach, 2001; Bryson and Rusten, 2005). Corrocher et al. (2009) applied the technique of cluster analysis to a sample of 441 KIBS in Lombardy and identified four patterns of innovation differentiating between KIBS whose clients belong to either, regional, domestic or international category. And although majority of KIBS in Lombardy region did not reach beyond the regional market, the share of national KIBS is between 10% and 20% in three clusters out of the total four. However, the proportion of KIBS that have foreign customers does not exceed 3% in any cluster.

Also, Aguilera (2003) shows that KIBS in Lyon metropolitan area gain 58% of their turnover from outside the region, whereas 6.7% of the turnover comes from exports abroad. Koch and Strotmann (2006) studied three regions in Germany (Munich, Stuttgart and Bremen) and showed that the average turnover from outside the region was 54%. Aslesen and Isaksen (2007) studied software and management consultants in Oslo, Norway and found that two thirds of their revenue comes from outside the local market.

It has been widely acknowledged that KIBS can develop relationships with customers, suppliers and others beyond the boundaries of the local context. Evidence also points that a large number of KIBS operate on the international scale (Bettiol et al., 2013). The most common way of internationalisation is via foreign direct investment which includes greenfield investments, acquisitions, joint ventures or use of personnel travelling overseas which is mainly due to the need for a close interaction between KIBS and their customers (Roberts, 1999; Miozzo and Soete, 2001; Bettiol et al., 2013).

In summary, Gallouj (1996) argues that while there are many empirical studies on KIBS tradability, they underlie broad disparities of exporting ability according to the type of service, location and firms' status and size. The exception is the study by Beyers and Alvine (1985) who found no correlation between the firm size and the degree of export market orientation. In this study firms with less than 15 employees performed equally well as larger firms. In line with the above research, the second research sub-question this chapter aims to answer is:

2. **Do KIBS which are (i) located in cities; (ii) larger KIBS and (iii) more mature KIBS exhibit higher propensity to export outside their region?**

5.3.3 KIBS Tradability-The Role of Intermediate Demand

In the UK previous research related to KIBS structural role showed that many KIBS offer routine, professional, financial and business expertise based on close familiarity and repeated business with clients located in their own or nearby regions (Keeble et al., 1991; Wood et al., 1993). A minority are also active in national and international markets often reflecting long established regional expertise, e.g. in engineering, design and logistics and more recently in IT and software often stimulated by the competitiveness of their clients (O'Farrell et al., 1998). In non-core regions KIBS growth often depends on advantages they offer over their core counterparts through providing specialist knowledge, lower cost and closer individual attention (Daniels and Bryson, 2005).

A number of more recent empirical studies assess KIBS relationships with manufacturing clients and report that their location near industrial belts creates specialisation of KIBS. Some of these studies are related to the oil extraction industry in Alberta, Canada (see for example Shearmur and Doloreux, 2008) and the port industry in Rotterdam (see for example Jacobs et al., 2014). Therefore, it can be assumed that given the relatively high concentration of manufacturing and public services in the West Midlands and the North East, these sources will comprise an important, local market for KIBS in de-industrialised regions. Thus, the third research sub-question that will be answered in this chapter is:

3. **Which sectors and in which locations provide the most important customer base for the North East and the West Midlands KIBS?**

5.3.4 KIBS Location and Decentralisation

Glasmeier and Howland (1993) point to the preferences of entrepreneurs to live in less congested, more attractive environments. This argument (related to KIBS decentralisation) emphasises non-traditional location factors, especially quality of life, as important for KIBS location. Howells (1984) found that the importance of good schools, adequate services, good cultural amenities and residential attractiveness score highly on the list of the location decisions of pharmaceutical firms in the UK. Keeble and Nachum (2002) also find support for the attractiveness of local amenities and good connectedness to London to form decisive location considerations amongst a group of decentralised KIBS in rural South East. However, this trend in the South East of England, which shows that rural areas have a chance of developing KIBS export base, largely applies to attractive and amenities rich areas whereas prospects for de-industrialised regions may be more uncertain. Hence, the fourth research sub-question that will be answered in this chapter is:

4. **What are the most important factors that explain KIBS location?**

5.4 The Empirical Specification

5.4.1 Analysis Technique

Many studies, which analyse the contribution of KIBS to regional growth and development, use the location quotient methodology. Location quotient measures a region's share of industry output or employment and compares that share with (that is, divides it by) a measure of the region's share of overall demand (typically measured using the region's share of total population or of total employment) (Jensen, 2013). If it has been observed that if more of a particular service has been produced in one location than consumers in that location are likely to be able to consume, then the excess services must be consumed elsewhere (Jensen, 2013). That implies that the service is being traded either nationally or internationally. This is the case with movies in Hollywood, financial industry in the City of London or internet service providers in Seattle and San Francisco (Jensen, 2013).

However, consumer services such as hair-cuts and visits to dentist are difficult to provide at a distance, they tend to be distributed in proportion to the population in a region hence we do not see large concentrations of these service activities in one place (Jensen, 2013). As a result their location quotients are uniformly low. The notion of using geographic concentration to identify tradable activities is related to a long tradition among geographers and regional economists. They largely employ the geographic concentration of economic activity in order to identify a region's export or manufacturing base (Jensen, 2013).

A more sophisticated analysis calls upon the estimation of interregional trade flows based on input-output methodology. The input-output methodology provides important information with respect to forward and backward linkages. This information acknowledges the importance of sectoral congruity. In the UK this presents an awkward problem due to limited amount of regional data available (Flegg and Thomo, 2013). Since input-output regional data on tradable services are made up (i.e. estimated from the national data) it is not possible to make highly precise conclusions about the extent and nature of KIBS sub-sectors trade activity from the available data. Hence, there is a scope for regional surveys to bridge this shortcoming. According to Beyers et al. (1985) no serious empirical work on service sector exports can be done until statistics offices are able to provide data on trade in services based on survey techniques.

Therefore, a number of advanced producer service studies, conducted in 1990s, tried to overcome problems associated with the lack of reliable input-output data by carrying out their own independent surveys (see for example Wood et al., 1993; Bryson et al., 1993; Beyers and Lindhal, 1996,1997; O'Farrell et al., 1996). This onset of research was sparked by a couple of studies from the US (Beyers et al., 1985 and Beyers and Alvine, 1985) which promoted survey based input-output methodology. These two early studies by Beyers and colleagues showed how important producer services were for trade and ultimately for regional development in the state of Washington (US).

In line with the above studies this chapter also utilises survey methodology with the aim of assessing KIBS exporting potential, main customer base, location decisions and demand side barriers that KIBS face. Survey questionnaire asked firms to allocate their revenue according to the type of market (manufacturing, services, individual consumers, universities and public sector) and geography of this revenue (regional, UK and international). Variables related to whether firm sells within the region, UK and abroad (binary variables) are derived variables. Detailed explanation of the survey variables is provided in the methodology chapter. For the clarity of analysis aimed at answering the above research questions, survey results are presented under the following headings:

- KIBS market extension by KIBS sub-sectors;
- KIBS market extension by the location, age and size of KIBS;

- Main customer base;
- Main factors which influence KIBS location decisions;
- The extent and importance of demand related barriers to KIBS success.

It should be noted that the sample of KIBS which reported information on their source of revenue is significantly reduced (Tables 5.2; 5.6 and 5.10 are based on information provided by 257 firms; Tables: 5.3; 5.7 and 5.11 are based on observations from 256 firms whereas Table 5.8 is based on observations from 255 firms and Table 5.9 on observations from 254 firms). And even though the margin of error for the reduced sample is still acceptable as explained in the methodology chapter there is still a possibility of a non-response bias. To check for possible non-response bias, non-respondents were compared to respondents in terms of size, industry and year of firm formation. However, it was not possible to compare the two groups based on their turnover which may still constitute a potential non-response bias.

5.5 Main Findings

5.5.1 KIBS Market Extension by KIBS Sub-sectors

The results displayed in Table 5.1 show that 39% of total KIBS revenue is generated from local or regional sales whereas 53% of total revenue is generated from outside of the home region but within the UK. A total of 56% of revenue is generated as extra regional revenue either in the UK or abroad. It should be noted that exports abroad generate only a small proportion of the total revenue amounting to 3%. The revenue from Domestic public procurements plays a slightly larger proportion (6%).

Table 5.1 Proportion of revenue earned by revenue source

Source of revenue	Total	%
Regional market	191,166,000	39
UK market	260,927,000	53
Foreign market	13,830,000	3
Domestic public procurements	30,402,000	6
Total	496,325,000	100

Source: KIBS Survey, 2010
Note: Revenue figures are rounded to the nearest thousand.
Note: Revenue figures are derived by using reported percentages of revenue sold to each: region, UK and international and total revenue variable to calculate nominal values.

The above results can be compared to the structure of trade for KIBS SMEs in the US investigated by Beyers et al. (1985 and 1986). The source of data for these studies was constructed from interviews with almost 2,000 Seattle KIBS. The authors report that non-local sales accounted for 36% of total revenue generated by Seattle KIBS. Further disaggregation of results showed that 11% of revenue was generated within Washington State, 22% within the US and 3% from international sources. Thus, 56% of non-local commercial activity reported in this chapter is higher than 36% reported for Seattle KIBS and also higher compared to 32% reported by Coffey and McRae (1989) in their study of Vancouver KIBS.

It should be noted, however, that geographical scale of regions in the US and Canada is much larger than that of UK regions, hence these comparisons should be placed within the context of geographical scale. However, compared to Aguilera (2003) and Koch and Strotmann (2006) who reported 58% and 54% extra-regional sales respectively, the North East and the West Midlands KIBS (with 56% of extra regional revenue) show very similar results.

Compared to Seattle KIBS, who generate 22% of their revenue from the US based sources and compared to Vancouver study, it seems that Seattle KIBS generate higher proportion of their sales from within the country (reported 22%), compared to the North East and the West Midlands KIBS. Compared to Seattle and Vancouver KIBS, the North East and the West Midlands KIBS generate remarkably higher revenue from within the country. Their reported revenue from within the UK is 53%. However, there is significant similarity between Seattle and the North East and the West Midlands KIBS in relation to their international export activity where both groups report 3% of the total revenue from abroad. Vancouver KIBS, in contrast, report 12% from international sales.

In summary, the overall importance of non-local KIBS sales is dissimilar between the North East and the West Midlands KIBS, on one hand, and Seattle and Vancouver KIBS on the other. However, the level of international sales is very similar for the North East and the West Midlands KIBS and Seattle KIBS, on one hand, and Vancouver KIBS on the other. Vancouver KIBS export much larger share of their services to international customers.

In Table 5.2 the numbers of firms in each KIBS sub-sector as well as percentages of firms who reported extra regional sales were compared to those who did not report extra regional sales. A Chi-square test was performed which compares proportions between the groups (sub-sectors). Null hypothesis is rejected as the statistical test shows that there are significant differences between the groups (p=0.012). It can be seen from the table that Advertising and Publishing firms as well as Engineers, Technical Testing and Analysis and R&D (90% and 88% of these KIBS respectively reported sales outside the region) have the highest propensity to export outside the region.

Architects and Urban Planners have the smallest propensity to export outside of the region (60% of the firms in this sub-sector reported sales outside the region). It should be noted that 79% of all firms do export outside the region. Hence, the answer to research sub-question 1 is that there are differences amongst the KIBS sub-sectors in respect to their tradability where Engineering, Computer, IT and Advertisers have higher propensity to export outside the region.

Table 5.2 Extra regional sales by KIBS sub-sector

			Firm doesn't sell outside the region	Firm sells outside the region	Total
	Computer and related	Count	13	60	73
		%	18%	82%	100%
	Marketing Research and Management Consultants	Count	18	68	86
		%	21%	79%	100%
	Engineers, Technical Testing and Analysis and R&D	Count	4	30	34
		%	12%	88%	100%
	Advertising and Publishing	Count	2	19	21
		%	10%	90%	100%
	Architecture and Urban Planning	Count	17	26	43
		%	40%	60%	100%
Total		Count	54	203	257
		%	21%	79%	100%

Source: KIBS Survey, 2010
Notes: X2=12.76; df=4; p=0.012

However, when exports abroad are considered results show that there are no statistically significant differences between KIBS sub-sectors. It should be noted however, that 25% of all KIBS do export abroad (Table 5.3). Advertising and publishing firms also have the highest propensity to export whereas Architects and Urban Planners have the lowest.

Table 5.3 Exporters by KIBS sub-sector

			If exporting abroad		
			Non exporter	Exporter	Total
	Computer and related	Count	54	19	73
		%	74%	26%	100%
	Marketing Research and Management Consultants	Count	64	22	86
		%	74%	26%	100%
	Engineers, Technical Testing and Analysis and R&D	Count	25	9	34
		%	74%	26%	100%
	Advertising and Publishing	Count	12	8	20
		%	60%	40%	100%
	Architecture and Urban Planning	Count	38	5	43
		%	88%	12%	100%
Total		Count	193	63	256
		%	75%	25%	100%

Source: KIBS Survey, 2010
Notes: X2=12.76; df=4; p=0.156

In Table 5.4a revenue earned by respondents was pooled and allocated to five different categories: Extra Regional market (includes sales abroad plus sales in the UK), Regional Market, UK Market, International Market and Other. KIBS sectors were disaggregated further to show more detailed analysis for all nine KIBS sub-groups. Information related to revenue by geography is presented by KIBS sub-sector. The results displayed in Table 5.4a show that Business and Management Consultants obtain the smallest amount of revenue within the region with only 3% of sales generated whereas the most locally tied sector are Architects and Urban Planners who report 37% of their sales generated within the region. Advertisers and IT KIBS earn 73% and 60% of their sales from UK and international markets respectively. Most internationally orientated KIBS sub-sector are Engineering firms followed by Business Consultants, earning 14% and 7% of their revenue from abroad respectively.

Table 5.4a Proportion of KIBS sub-sectors' revenue by revenue type

Industry	Extra Regional Market (includes UK and International)	Regional Market	UK market	International Market	Other
	%	%	%	%	%
Computer and related	60	15	52	7	25
R&D	4	0	1	3	96
Marketing Research	100	0	100	0	0
Business and Management Consulting	32	3	30	2	65
Architecture and Urban Planning	51	37	51	0.4	12
Engineering	30	22	16	14	48
Technical Testing and Analysis	44	10	44	0	47
Advertising	73	13	71	1	14
Publishing	52	48	51	0	0

Source: KIBS Survey, 2010

When the data on type of clients are disaggregated by sector, some important differences occur and it must be noted that many firms have stated "other" as their chosen category. This information is presented in Table 5.4b. For SMEs in the Computer and related sector, results confirm that the majority of their clients belong to the UK and Regional consumer category represented by 41% and 12% of the total sales respectively. Another 6% of revenue for this KIBS sub-group comes from foreign consumers (6%) and UK services (6%). The results show that Computer and related KIBS are mostly dependent on consumers/households, which when added together make up a total of 59% of total sales revenue. It should be noted that Computer firms earn 25% from the "other" category.

Closer inspection of the qualitative responses in the survey which are related to the "other" category shows that establishments in Computer and related group cite the following markets as most common source of their revenue: Schools, hospitals and local authorities; Telecoms and military; Transport; Design agencies; Retail; Recycling; Ministry of Defence; Health services; Travel agents; Solicitors, schools and public sector; Large corporations (more than 250 employees); Research and Distribution; General public; US Air Force; Engineering, Universities and Colleges; Event organisers; Blue chip companies; Software companies; Control companies; Corporate SMEs and schools; Colleges and estate agents; General public; SMEs; Charities. It can be concluded that, compared to other KIBS sub-groups, Computer firms draw most of their income from households/consumers but also from other service firms and public and education sectors.

Survey results for R&D show that firms in this group gain 3% of their revenue from foreign universities and 96% from the "other "category. Qualitative analysis of the "other" category indicates that important sources of demand include Local authorities; Public sector and Domestic public procurements. Results for Marketing research should be interpreted with caution, as there are only two firms included in the sample. These two firms draw 100% of their revenue from other services, which are based outside their own region.

Business and Management Consulting firms draw 26% of their revenue from service firms, which are located outside their region. Analysis of the "other" category for this group shows that important sources of demand include: Private sector and commercial clients; Business start-ups; Developers; UN and International Labour Organisation (ILO), Retail; Food, plastics, chemicals and recycling; Building companies; Police and solicitors; Casio operators; Pharmaceuticals; Consumer companies; Charities; SMEs of any type; Entertainment industry; Doctor surgeries and pharmacies; Food production; European Commission; Corporates; Social Enterprises; Infrastructure companies in a railway industry; Franchises; Overseas government organisations, Farming estates and Banks and car companies. It can be concluded that Business and Management Consultants are most tightly linked to other services but serve wide spectrum of industries in both private and public sectors. Also their geographical reach is mostly UK wide.

Architects and urban planners are most tightly linked to domestic public procurement contracts (comprising of 32% of the total revenue for this KIBS sub-group) and regional consumers (23% of the total revenue for this KIBS sub-group). They seem to be the most parochial and dependant on local sources of wealth compared to all other KIBS. This finding puts them in contrast with many architecture firms located in London and the South East, which have access to worldwide markets (Tether et al., 2012).

Engineering KIBS seem to be most tightly linked to manufacturing demand and this is clearly a defining characteristic for this group. And although they earn 20% and 12% of their total revenue from regional manufacturers and manufacturers located elsewhere in the UK respectively it should be noted that 14% of their sales comes from manufacturing firms which are located abroad. Technical testing and analysis firms, however, depend largely on Domestic public procurement contracts as 42% of their revenue comes from this single source. Another 9% for this group is earned from regional services.

Closer inspection of the "other" category for both Engineering firms and Technical testing and analysis points to the importance of the following sources of demand for their services: Construction companies; Heritage companies; Nuclear power stations, Ministry of Defence, Mainly off shore construction; Power generation; Schools; SMEs, Property developers and utilities; Structural and civil engineers. It can be concluded that KIBS in these two categories (Engineers in particular) serve relatively specialised niche markets at home and abroad.

KIBS in the Advertising category also largely depend on public procurement contract (54% of the total revenue). The rest of their revenue is quite widespread ranging from 8% gained from UK services and another 8% form regional services, followed by 6% from UK consumers. Publishers earn most of their revenue from UK services (27%) and 24% from the following sources combined: UK consumers; Regional consumers and Regional services.

In summary, analysis by the type of client shows the overall importance of the service sector as a source of demand for Business and management consultants, Publishers and to an extent Advertising firms and Architects and urban planners. However, it should be noted that Publishers also depend on consumers for their final demand and that Advertisers and Architects and urban planners draw significant proportion of their revenue from domestic public procurement contracts.

Business and management consultants and Marketing research KIBS are not overly linked to demand originating in the household/individual, primary/manufacturing or public sector of the economy. Each of the other sub-categories of KIBS has an important demand side link to either, households, government or manufacturing sector. For example, KIBS firms in the Computer and related category earn a significant portion of their revenue selling output to UK, regional but also foreign households and individuals. KIBS in the R&D category depend largely on government contracts as do Advertisers and Technical Testing firms and Architects whereas Engineering firms are closely tied to manufacturing sector whether based in the region, UK or abroad. Publishers are also significantly tied to consumer demand based in the region but equally important are UK wide based consumers.

The net result is that each sub-sector has important links to different sources of demand and that Business and management consultants have the strongest link to other services whereas Engineers have the weakest link to services when compared to all other KIBS sub- categories. Indeed ANOVA test shows statistically significant differences between KIBS sub-sector groups for all demand source categories, apart from Foreign Consumers and UK Universities. This observation can be overlooked when dealing with pooled data.

The above analysis by KIBS sub-sectors can be compared to a study of Montreal KIBS by Polese and Leger (1982) which indicates that sales to other Canadian regions accounted for 4.9% of income for Management consultants, 18.1% for Advertising firms and 10.7% for Computer service firms in 1980. International sales amounted to 8.1%, 6.5% and 1.1% respectively. These findings show that Quebec is a rather distinct market, which also raises some interesting questions regarding the role of language. For example, if a firm in Abitibi seeks KIBS service in French, it is less costly to seek it from Montreal rather than Toronto even though the distance between the two metropolitan centres is the same (Coffey and Polese, 1987). It follows that the Montreal market will remain rather regional.

This is in stark contrast to the North East and the West Midlands results which show that Management consulting, Advertising and Computer KIBS source as much as 30%, 71% and 52% of their revenue from other regions in the UK (table 5.4a). However, their international reach is weaker compared to Montreal firms (except for IT, Computing and related firms which source 7% of their revenue from abroad compared to only 1.1% of Montreal KIBS). These findings should be placed in the geographical perspective as the North American market is much larger than the UK market. Both Montreal and the West Midlands and the North East KIBS have built strong international exporting capability among their Engineering KIBS. Despite this, it should be noted that a significant proportion of their income is tied to regional manufacturing demand (see section 5.5.3).

Table 5.4b KIBS sub-sectors proportion of revenue by the customer type

	UK Manufacturing	Regional Manufacturing	UK Services	Regional Services	Foreign Manufacturing	Foreign Services	UK Consumers	Regional Consumers	Foreign Consumers	UK Universities	Foreign Universities	Domestic Public Procurements	Other	Total
KIBS sub- sectors	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**
Computer and related	1.2	0.8	6.2	2.4	0.4	1.0	40.9	11.9	5.8	1.2	0.0	2.9	25.1	100
R&D	0.2	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.6	95.7	100
Marketing Research	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100
Business and Management Consulting	1.0	1.7	26.3	1.0	0.7	1.0	1.1	0.8	0.1	0.1	0.0	1.2	65.0	100
Architecture and Urban Planning	7.0	4.4	9.2	8.8	0.0	0.4	2.1	23.5	0.0	0.3	0.0	32.2	12.0	100
Engineering	11.6	19.8	0.8	0.4	13.9	0.2	1.8	1.8	0.0	0.0	0.0	1.3	48.3	100
Technical Testing and Analysis	0.2	0.3	0.0	9.3	0.0	0.0	1.2	0.2	0.0	0.3	0.0	41.9	46.5	100
Advertising	1.8	3.7	8.4	8.2	0.3	0.2	5.6	1.3	0.0	1.8	0.8	53.6	14.2	100
Publishing	0.0	0.0	27.5	24.1	0.0	0.5	23.9	23.9	0.0	0.0	0.0	0.0	0.0	100

Table 5.5 presents results of the Factor analysis, which was used to provide aggregation and normalisation of the type of market. The aim was to provide a better understanding of the structure of the set of demand variables. Five factors with Eigen value of greater than 1 were extracted by Varimax rotation. The results are presented in Table 5.5. An interpretative description of the factors is also provided in Table 5.5. Factor analysis shows some interesting results. The first factor-Regional and UK consumers and services suggests that firms who serve consumers are also likely to serve other services who can be based within the region but also elsewhere in the UK. The second factor-Manufacturing suggests that if a firm serves manufacturers within a region it is also likely to serve this industry elsewhere in the UK and abroad. For the third factor-Public procurements and UK universities it is evident that firms tend to use both of these sources for generating revenue, whereas Foreign Services and Foreign Consumers categories do not correlate with other sources of revenue.

Table 5.5 Factor analysis: Type of revenue

	Regional and UK Consumers and Services	Manufacturing	Public procurements and UK universities	Foreign Services	Foreign consumers
Regional Consumers	.995				
Regional Services	.993				
UK Consumers	.973				
UK Services	.946				
Foreign Manufacturing		.961			
UK Manufacturing		.949			
Regional Manufacturing		.915			
Domestic Public Procurements			.783		
UK Universities			.644		
Foreign Services				.908	
Foreign Consumers					.970

Notes: Explained variance= 82.188; Kaiser-Meyer-Olkin (KMO) test= 0.641; Bartlett's test of sphericity: X2=4386.488; p=0.000

5.5.2 KIBS Market Extension by the Location, Age and Size of KIBS

Further analysis relates to firms' market extension by firms' location, size and age. Table 5.6 shows that 74% of firms located in the city sell outside the region whereas 81% of firms, which are located in town, village or countryside, sell outside the region. It should be noted that these results are not statistically significant.

Table 5.6 Regional and extra regional sales by firm location

			If selling outside the region		
			Firm doesn't sell outside the region	Firm sells outside the region	Total
Location	Town, Village or Countryside	Count	36	152	188
		%	19%	81%	100%
	City	Count	18	51	69
		%	26%	74%	100%
Total		Count	54	203	257
		%	21%	79%	100%

Source: KIBS Survey, 2010
Notes: X2=1.46; df=1; p=0.226

Exports analysis shows that 19% of firms located in cities exported abroad whereas 27% of those located in towns, villages or countryside exported abroad. Hence, in answer to research sub-question 2, which concerns differences between city based KIBS and others, it can be concluded that KIBS located outside cities report higher exports outside the region compared to their city counterparts. It should be noted that these differences are not statistically significant.

These results can be compared to a recent study by Herstad and Ebersberger (2015). They studied Norwegian KIBS and found that those located in peripheral areas are not as likely to reach out to extra-regional markets compared to their urban counterparts. This is in contrast to present study which shows that the North East and the West Midlands

KIBS located in towns and rural areas are more likely to report extra regional sales as their city counterparts.

Table 5.7 Exports by firm location

			If exporting abroad		
			Non exporter	Exporter	Total
Location	Town, Village or Countryside	Count	137	50	187
		%	73%	27%	100%
	City	Count	56	13	69
		%	81%	19%	100%
Total		Count	193	63	256
		%	75%	25%	100%

Source: KIBS Survey, 2010
Notes: X2=1.69; df=1; p=0.193

From the sample of 255 firms who provided information on their sales, 13% of firms were classified as young, 33% were classified as medium and 54% were classified as mature[20]. Table 5.8 shows that 75% of young firms had sales outside their region, which means that the vast majority of this group reported that they have earned revenue from sources outside their region but within the UK. For medium and mature firms, the percentage of firms who reported earned revenue outside the region is 75% and 83% respectively. It should be noted that there are no statistically significant differences between the age categories of KIBS with respect to the geography of their revenue.

The results for young firms imply that majority have extra-regional exporting capability or in other words, the majority (75%) of young firms do not depend exclusively on local markets within the first 5 years of starting up. Another conclusion from the analysis related to more mature firms is that many develop exporting capability as they mature. Compared to young

[20] Firms aged 1-5 were classified as young, those aged 6-10 as medium and those aged 11+ as mature.

firms a higher proportion of mature KIBS serve non-local markets. This finding provides some support for learning-to-export argument.

Table 5.8 Regional and extra regional sales by firm vintage

			If selling outside the region		Total
			Firm doesn't sell outside the region	Firm sells outside the	
Firm age	Young	Count	8	24	32
		%	25%	75%	100%
	Medium	Count	21	64	85
		%	25%	75%	100%
	Mature	Count	23	115	138
		%	17%	83%	100%
Total		Count	52	203	255
		%	20%	80%	100%

Source: KIBS Survey, 2010
Notes: X2=2.57; df=2; p=0.276

Table 5.9 shows that the highest proportion of exporters belong in the medium category (27%). Amongst the mature category, 25% of KIBS gained revenue from abroad whereas only 19% of young firms are exporters. However, these results should be interpreted with caution, as they are not statistically significant. Hence, in answer to research sub-question 2, which concerns differences in exporting potential amongst, older vs. younger KIBS, it can be concluded that relatively older KIBS do seem to have slightly higher propensity to export though these results should be interpreted with caution as they are not statistically significant.

Table 5.9 Exports by firm vintage

			If exporting abroad		Total
			Non exporter	Exporter	
Firm age	Young	Count	26	6	32
		%	81%	19%	100%
	Medium	Count	62	23	85
		%	73%	27%	100%
	Mature	Count	103	34	137
		%	75%	25%	100%
Total		Count	191	63	254
		%	75%	25%	100%

Source: KIBS Survey, 2010
Notes: X2=0.86; df=2; p=0.276

Within the sample of 257 KIBS, 191 firms or 74% were classified as micro, 40 firms or 16% were classified as small and 26 firms or 10% were classified as medium[21]. Table 5.10 shows that in each category there were more firms who gained revenue from outside the region compared to those that did not. This finding is particularly important for micro firms who are often perceived as less able to reach non-local markets. It should be noted, however, that there are statistically significant differences between the firm size categories (p=0.050) and results show that micro firms have the smallest propensity to sell outside the region compared to small and medium firms (76%, 83% and 96% respectively). Hence, in answer to research sub-question 2, which considers exporting differences between larger and smaller KIBS SMEs, it can be concluded that larger KIBS do have a higher propensity to sell outside the region.

[21] Firms with 1-5 employees were classified as micro, those with 6-25 employees as small and those with 26+ employees as medium.

Table 5.10 Extra regional sales by firm size

			If selling outside the region		
			Firm doesn't sell outside the region	Firm sells outside the region	Total
Firm size	Micro	Count	46	145	191
		%	24%	76%	100%
	Small	Count	7	33	40
		%	18%	83%	100%
	Medium	Count	1	25	26
		%	4%	96%	100%
Total		Count	54	203	257
		%	21%	79%	100%

Source: KIBS Survey, 2010
Notes: X2=5.9; df=2; p=0.050

When exports are analysed, taking account of the firms' size, there are no statistically significant differences. However, the results show that 23% of micro firms are exporters, 25% of small firms export abroad and the highest percentage of exporters (35%) comes from the medium category (Table 5.11).

Table 5.11 Exports by firm size

			If exporting abroad		
			Non exporter	Exporter	Total
Firm size	Micro	Count	146	44	190
		%	77%	23%	100%
	Small	Count	30	10	40
		%	75%	25%	100%
	Medium	Count	17	9	26
		%	65%	35%	100%
Total		Count	193	63	256
		%	75%	25%	100%

Source: KIBS Survey, 2010
Notes: X2=1.63; df=2; p=0.444

The above results can be compared and contrasted to Seattle studies which find that small KIBS are as likely as large ones to report non-local sales. This finding differs from Vancouver results, which show that larger KIBS are more active in national and international markets. And even though the North East and the West Midlands micro, small and medium KIBS sell outside the region, international sales are more pronounced for medium KIBS.

5.5.3 The Main Customer Base

The survey questionnaire asked respondents to allocate their revenue by location (regional, UK and international) and according to the type of customer namely: business establishments in the manufacturing sector; business establishments in the service sector; households/consumers; universities and local and central government contracts. It should be noted that the number of usable responses is down to 225 firms due to a number of firms who refused to report this information.

The results in Table 5.12 show that the main source of revenue for the West Midlands and the North East KIBS comes from services and consumers whereas, manufacturing demand plays a much smaller role. However, more detailed analysis of the survey data shows that Engineering KIBS draw as much as 32% of their revenue from the manufacturing sector (of this, 20% is from the regional manufacturing base).

Table 5.12 Total Revenue by type of customer

	Manufacturing	Services	Consumers	Universities	UK Government	Total Revenue
Number of observations	225	226	226	226	226	226
Total Revenue by Type of Customer	19,624,000	240,038,000	203,471,000	2,790,000	30,402,000	496,325,000
Percentage of Total Revenue	4	48	41	1	6	100

Source: KIBS Survey, 2010
Note: Figures are rounded to the nearest thousand

The results displayed in Table 5.13 show that 82.7% of firms who responded to the question report that they earn no revenue at all from the direct sale of their services to households or consumers. However, 5.8% of KIBS are very tightly linked to households/consumers, selling between 75-100% of their total revenue to this group. Table 5.13 also shows that KIBS sales to the public sector (central and local government) earn no revenue for 81.4% of firms in the sample. In addition, 90.7% of firms earn no revenue from universities. Similarly to the households/consumers and government contracts, sales to universities are not overwhelmingly important for the vast majority of KIBS.

Demand side linkages to manufacturing sector firms should be interpreted with caution. Table 5.13 shows that 66.8% of KIBS do not sell any services to the manufacturing sector. This may be interpreted as evidence of low-level linkages between KIBS and manufacturing. However, it should be emphasised that KIBS SMEs who do sell their services to the manufacturing sector typically earn substantial revenue from this source. It is noted that 6.6% of KIBS SMEs are very tightly linked to manufacturing as they earn between 50-75% of their revenue from this source whereas another 8.8% of firms earn between 50% and 75% of their revenue from this particular source. The data in Table 5.13 should be interpreted bearing in mind that 79 firms stated “other” as their revenue category.

Table 5.13 Percentage distribution of sample establishments’ revenue by quartile by customer

Percentage of total gross revenue	Manufacturing	Services	Consumers	Universities	Government contracts
0	66.8	58.4	82.7	90.7	81.4
1-25	5.8	8.8	4.9	5.3	4
25-50	11.9	10.6	3.5	0.4	3.5
50-75	8.8	12.4	3.1	1.8	4.4
75-100	6.6	9.7	5.8	1.3	7.1

Source: KIBS Survey, 2010

The data in Table 5.13 indicates that the main market for the North East and the West Midlands KIBS SMEs consists mostly of other services. The evidence also shows that manufacturing industry is an important source of demand for some KIBS. Survey results show a proportionately lower percentage of KIBS SMEs (58.4%) who earn no revenue from selling their services to other service firms compared to all other categories of final demand. The remainder sell some proportion of their revenue to other services and 9.7% are tightly linked to other services as they earn between 75% and 100% of their revenue from this category.

Another 12.4% of KIBS SMEs are also linked to other services earning between 25-50% of their revenue from this source. This suggests that job growth in KIBS is supported by demand from services and to a lesser extent from the industrial base. Hence, in answer to research sub-question 3, which considers the most important sources of demand for KIBS, it can be said that manufacturing demand is less important for KIBS whereas demand from other services plays more important role. It should be noted, however, that manufacturing is still an important source of demand for a number of KIBS SMEs.

In comparison, both Vancouver and Seattle studies confirm that the most important clients, as identified by KIBS, are other services. According to Beyers (2002), in line with his emphasis on the “New Economy”, such findings casts doubt on the theory of service employment growth caused by the expanded demand for services as inputs to manufacturing. The results from this study show that KIBS depend on demand from services more than on demand from manufacturing. Nevertheless, the importance of manufacturing base for some of the North East and the West Midlands KIBS should not be underestimated.

5.5.4 Main Factors which Influence KIBS Location Decisions

To identify factors which influence firms to locate in a particular region or to choose a specific site within the region is an important task for regional development policy. This issue was addressed in KIBS survey. Interviewees were asked (for each of the nine location preferences given in Table 5.14) to rate the importance of the location decision on a ten point Likert scale ranging from 1- not important to 10- very important. It should be noted that the limitation of this measure is that it reflects the subjective perceptions of firms' owners/managers. However, it is only by these types of survey questions that systematic analysis of the range of location factors can be achieved.

Table 5.14 displays the percentage of respondents in each KIBS sub-sector who stated that proximity to customers was important for their location decision[22]. Among the establishments in the Architecture and Urban Planning group, 29% stated that proximity to customers is important location decision while only 3% of establishments in Engineering, Technical Testing and Analysis and R&D stated that proximity to customers is important consideration in their location decision.

For KIBS SMEs in all categories, the most important location decision is a simple fact that the founder or owner of the company lives in the area. Another decisive factor is good quality of life. Based on this information, the general picture which emerges is of a sector whose firms are not attracted by the existence of some unique, low cost or factor of production, or overly important linkages to other market areas. A general picture which emerges from this data is of establishments who are indigenous to the local economy in a sense that personal preferences (such as good quality of life and the fact that founder/owner was born in the region) prevail over other considerations. It should be noted, however, that proximity to customers does not play important role in location decisions except for Architects and urban planners who, from the proceeding analysis, also seem mostly tied to regional demand.

For Marketing researchers and management consultants and Engineers, R&D and technical testing and analysis category, proximity to founders home represents a decisive location factor whereas proximity to customers seem of very little importance. This implies that these two KIBS sub-sectors are most footloose, even though proximity to suppliers does matter for Engineers, R&D and technical testing firms to an extent. Low cost of premises seem to be an important factor for Computer and related firms and well as Advertisers and publishers and generally plays more important role for all KIBS when compared to proximity to markets,

[22] Category "Important" was created by taking account of those KIBS who chose any value from 5-10, on a Likert scale, to questions related to reasons for locating in the region.

networks, skilled staff or availability of other firms in the same industry. As proximity to suppliers and to other firms in the same industry do not seem to be of great importance, hence it seems that localisation economies do not provide satisfactory conceptual basis for explaining location of KIBS SMEs. Thus, in answer to research sub-question 4, which considers main factors in KIBS location decisions, it seems that localisation economies and geographical proximity to the customer base of the region are less important compared to the quality of life and availability of local amenities.

Table 5.14 Reasons for locating in the region

	Computer and related	Marketing Research and Management Consultants	Engineers, Technical Testing and Analysis and R&D	Advertising and Publishing	Architecture and Urban Planning	All firms
Proximity to Customers	31%	22%	17%	32%	39%	27%
Proximity to Suppliers	9%	11%	17%	16%	14%	12%
Availability of skilled staff	27%	19%	31%	44%	29%	26%
Proximity to other firms in the same industry	16%	10%	19%	4%	22%	15%
Availability of informal networks	29%	19%	22%	24%	22%	23%
Good international connectivity	21%	20%	17%	12%	10%	18%
Low cost of premises	40%	32%	33%	46%	29%	35%
Proximity to owners home	82%	88%	78%	72%	82%	83%
Good quality of life	65%	69%	64%	52%	58%	64%

Source: KIBS Survey, 2010

Findings also suggest that for majority of firms, whether located in a city, town and rural area, personal factors outweigh heavily in location decisions with good quality of life also playing a decisive role. The main conclusion is that these are indigenous firms meaning that owners/managers reside in the locality.

It should be noted that city located KIBS place more importance on all location consideration, except for proximity to founder's home and good quality of life, when compared to KIBS who reside in towns, villages or countryside. When answers to location decision are compared between firms located in the two regions, results show statistically significant difference only for the category Good International Connectivity (p=0.002). The West Midlands KIBS place significantly higher importance to Good International Connectivity when choosing their location.

In comparison, both Vancouver and Seattle studies find that KIBS are relatively young and dynamic sector. The West Midlands and the North East KIBS are also relatively young and home grown or indigenous to their respective regions and most locate in close proximity to founders home.

5.5.5 The Extent and Importance of Demand Related Barriers to KIBS Success

Table 5.15 Demand side barriers to firms' success

	West Midlands	North East	Total
Long distance to main markets	11%	21%	16%
Unable to access markets outside the region	12%	19%	15%
Increasing competition from firms located outside the region	23%	28%	25%

Source: KIBS Survey, 2010

Table 5.15 shows results related to the final issue of demand related barriers to firms' success. The results for both the West Midlands and North East show that the most significant demand side barrier variable[23] is Increasing competition from other firms, which are located outside of the region. It should be noted that firms in the North East put stronger emphasis on Long distance to main markets and inability to access markets outside the region compared to the West Midlands firms.

[23] Percentages are based on answers to demand side barriers recorded on a 5-10 Likert scale.

5.6 Conclusion

This chapter is concerned with KIBS' structural role. In order to determine this role, the conceptual framework was proposed to assess KIBS' exporting potential outside the region and internationally as well as their client profile. This is because first, KIBS' exports generate income which though multiplier effect contributes to regional growth. Moreover, one thing that the data on exports shows is that services in question can also be imported by the region. Hence, the regional part of KIBS turnover is potentially import-substituting. Second, KIBS act as facilitators of knowledge and innovation in their clients who as a result may become successful innovators and exporters in their own right.

The conceptual contribution this chapter makes is in joining the theoretical blocks related to KIBS tradability with the role of intermediate demand and location but also in explicit consideration of the role of both geographic and sectoral proximity. This approach challenges the array of related concepts namely: "the death of distance", "footloose hypothesis" [24] or the view that "the world is flat". These three concepts imply that information and communication technologies allow KIBS to access distant markets, favouring their location away from the main concentrations of business activity. The implicit assumption is that KIBS are widely tradable and mostly independent from the local industrial base. In summary, these concepts suggest that local markets matter very little or rather that being geographically close to sources of demand is not necessary. This research challenges such idea by recognising that in some regions local markets may be more important than in others. Local markets may be more important for particular KIBS sub-sectors too.

The results from the West Midlands and the North East survey show that although KIBS play an important role in local economic base of de-industrialised regions, they are not as important as elite, globally traded KIBS in metropolitan cities such as London. KIBS in de-industrialised regions provide mostly indirect support to their regional clients but the vast majority have access to UK wide markets. Some of these KIBS SMEs

[24] The implication for KIBS in peripheral regions, however, is that they will be faced with the competition from their metropolitan counterparts.

(Engineering in particular) are associated with the underlying industrial specialisation and declining manufacturing base. Many also depend on public procurement contracts.

This implies that further decline of manufacturing industry will also result in decline of some KIBS and that in de-industrialised regions KIBS may not provide a substitute for the losses being incurred in manufacturing, financial and public sector. The danger is that many KIBS in de-industrialised regions may just become part of a value chain that dissolves locally. For policy makers, who seek to address regional disparities in Great Britain, these findings create a challenging problem suggesting that recession (accompanied by ongoing de-industrialisation and future public sector job losses) is likely to worsen rather than reduce regional disparities. This is because prospects for KIBS led growth will be hampered by declining demand for their services.

Following this line of reasoning, it seems that KIBS might be more dependent on effective regional innovation policies as a whole rather than initiatives aimed specifically at services (Herstad and Ebersberger, 2013). However, important sub-sectoral differences emerge from this research and indicate that some KIBS are more tied to the existing industrial profile of their respective region than others (the vast majority depend on other services and consumers though). It is such KIBS that may benefit from the demand side regional innovation policies based on supporting old industrial formations.

The survey results support the contention that KIBS internationalisation potential in de-industrialised regions may be found in engineering and design activities based on established industrial, mining or maritime industries and associated trading traditions (for example Engineering KIBS). ICT related KIBS also have access to extra-regional, mostly UK wide markets. It follows that support may consist of helping KIBS SMEs to access UK and international markets. Support may also include building local demand for Engineering KIBS services through technological upgrading of existing industrial formations. Nevertheless, since most KIBS rely on other services there is a scope for devising sector specific services orientated policies (Rubalcaba, 2007). These may consist of supporting services innovation and exports as well as (from the supply side) regional skills base.

The survey findings also suggest that for the sample of KIBS, personal factors often weight heavily in location decisions with quality of life as the most important factor, followed by low cost of premises. This implies that most KIBS are home grown but also that there is some scope for attracting more “footloose” KIBS to de-industrialised regions by providing better amenities and reduced office rents. The final conclusion, however, is in line with Wernerheim and Sharpe (2002, 484) who note that policy should focus on facilitating the contribution of more peripheral KIBS although it may be smaller and more limited than that of the core regions counterparts. This will be more effective than relying on "footloose" firms to deliver gains that may prove elusive (Wernerheim and Sharpe, 2002, 484). It follows that policy may be more effective if directed at providing support to existing KIBS rather than trying to attract "footloose" KIBS to more peripheral regions.

While this chapter concentrates on the structural role the next chapter analyses the systemic role KIBS play in regional economies of de-industrialised regions. Through their role in investment, innovation and technological change, KIBS may contribute to spatial variation in the economic development process (Coffey and McRae, 1989). KIBS are regarded as strategic sector within production systems as they constitute a part of the overall division of labour (Walker, 1985). Hence, in the next chapter KIBS are analysed as innovators and knowledge facilitators who source knowledge from various external networks and contribute to a build-up of local pool of knowledge. The assumption is that KIBS not only benefit their clients but also induce knowledge spill-over effects among other actors in the regional innovation system.

CHAPTER 6: THE DETERMINANTS OF KIBS INNOVATION

6.1 Introduction

This chapter is concerned with the KIBS systemic role and the main research question it aims to answer is: **What are the determinants of KIBS innovativeness?** The conceptual framework adopted in this chapter is developed to establish the role of KIBS in regional economic development by investigating the effect of external knowledge sources and their geography (networks) on innovation activity in KIBS SMEs as well as the role of R&D (absorptive capacity). The aim is to provide results which are applicable to both case study regions and other regions which may be characterised as de-industrialised.

Establishing and supporting inter-firm co-operative ties with the aim of improving innovative performance of firms is very much in vogue within the current policy thinking (Tomlinson, 2010, 762). In the case of the UK, Huggins (2001) first considered the value of these inter-firm networking initiatives which emanated during the late 1990s and which still shape policy focus (Tomlinson, 2010). However, studies on external sources of knowledge and innovation amongst service providers are rare (Leiponen, 2012; Mina et al., 2014). Most research on KIBS innovation focuses on KIBS for their role as knowledge brokers and innovation generators (Den Hertog, 2000) but only rarely attention has been paid to how networks and external knowledge affect innovation within KIBS (Janssen and Castaldi, 2014). The empirical analysis conducted in this chapter aims to bridge this gap by investigating the effect of external knowledge on KIBS innovativeness.

The results show that innovation is supported by knowledge generated from frequent interaction with regional and UK customers as well as more frequent interaction with local business networks, including informal contacts as well as national licensing arrangements, regional and

UK commercial networks and UK public and professional infrastructure. Innovation capability is also enhanced by internationalisation through both traded and untraded relationships. Various industry-specific business networks and regional government agencies also act as important sources of knowledge and networking in de-industrialised regions. No support is found for benefits arising from clustering of firms in a similar line of business or with regional universities or public sector organisations. Also, while positive effect of R&D on KIBS innovativeness is acknowledged the results show that this effect is less important compared to regional and extra regional knowledge sources.

This chapter initially presents a review of existing theoretical and empirical research related to the role of R&D; external networks as well as localised and non- localised learning in facilitating innovation in KIBS and generally (Section 6.2 and 6.3). The data analysis techniques are then presented (Section 6.4), followed by the main results (Section 6.5), discussion and conclusion (Section 6.6).

6.2 The Conceptual Framework

Networks and Innovation in KIBS

In the literature, the role of co-operative ties for innovation within regional agglomerations and clusters in particular, has attracted significant attention. One of the most prominent models has been that of Italian industrial district (Tomlinson, 2010). In this model the emphasis is on horizontal co-operation between co-located SMEs, based upon mutual trust and reciprocity (see for example Becattini, 1990; Brusco, 1982). More recent findings from the regional innovation literature show that inter-firm networking is considered as a crucial element in the economic success and competitiveness of regions (Asheim el al., 2003; Bathelt el al., 2004; Cooke et al., 2004). Networking is usually used to explain the success of some of the most innovation rich regions throughout the world. This has resulted in the innovation process at the regional level being conceived as systemic, where encouragement is given to both formal and informal networking with universities, R&D labs and other firms (Huggins and Johnston, 2010, 464).

However, even those locations rich in knowledge benefit from non-local networks (see for example Doloreux, 2004; Davenport, 2005). Social network analysis has the potential to contribute to the analysis of regional innovation systems (Cooke, 2001). The regional innovation systems literature claims that innovation process is harmed when organisations such as research institutes and/or educational facilities are not well developed or not well connected in a particular region (Ter Wal and Boschma, 2009). By conducting the analysis of social networks, the concept of regional innovation system can be disentangled more systematically by mapping the network relations of key agents within and outside the region (Ter Wal and Boschma, 2009). In sum, network theory serves to enlighten the literature on clusters, innovation systems and knowledge spill-overs by considering the importance of intra-regional as well as extra-regional ties and relationships.

This chapter makes a conceptual contribution by bringing together theoretical perspectives from network theory as well as literature on KIBS innovativeness. In line with Huggins and Johnston (2010), this chapter acknowledges that both social capital (in form of social networks) and network capital (in form of more strategic networks) are important for innovation. In the literature, networks have also been classified into: contact networks (through which firms source external knowledge) and alliance networks (through which firms collaborate to innovate) (Huggins and Johnston, 2010). These two types of classification are particularly useful as they make the distinction between formalised or contracted relationships such as joint ventures and non-formalised types of interaction. It is further acknowledged that smaller firms utilise social networks with friends and family more frequently (Huggins and Johnston, 2010). Also, it is believed that networks of small firms tend to be more localised compared to larger firms (Huggins and Johnston, 2010).

KIBS are an extremely important component of the service economy (Rubalcaba and Kox, 2007). They have been described in the literature as key innovation intermediaries or “brokers” who excel at connecting innovative ideas developed by other individuals and organisations while translating new knowledge developed by the science base into commercial outputs (Tether and Tajar, 2008). KIBS chose to engage in either contractual arrangements or in informal exchange. The later include interaction with collaborators and participation in innovation networks. This chapter, therefore, provides evidence related to formal and informal networking.

It is expected that the intangible nature of services will favour informal over formal arrangements (Mina et al., 2014). Further, engaging with market based partners can be especially useful for services because of the co-production of their output with customers (Miles, 2005). However, universities and public research institutes may be more important for Technology KIBS compared to Professional KIBS. Hence, in line with previous literature (Mina et al., 2014) this research distinguishes between science-based and market-based partners.

6.3 Existing Empirical Evidence

6.3.1 The Role of External Sources of Knowledge in KIBS Innovativeness

It has been argued that interaction with suppliers, customers, public agencies, business networks, industry associations, informal contacts, competitors and universities in any type of region can provide missing inputs into the learning process which the firm alone may not be able to provide (Romijn and Albaladeijo, 2002). Interaction may serve the purpose of gathering information about markets, technologies, availability of government support and grants, HR practices, taxing and accounting rules and legislation (Romijn and Albaladejo, 2002).

Within the more specialised literature on service innovation and service management, the role of customers in co-creation of innovation has been receiving most attention (Bryson et al., 2012). Almost anonymously scholars find that customers' involvement contributes to service innovativeness (see for example Leiponen, 2005; Tether, 2005; Love et al., 2011). Moreover, the evidence shows that KIBS are involved in interactive learning processes both with their customers and with other organizations within the *local* innovation system (Strambach, 1998; den Hertog, 2000). The importance of geographical proximity for knowledge sharing and innovation between KIBS and clients has been noted in a number of studies (see for example Koschatzky, 1999; Muller and Zenker, 2001; Keeble and Nachum, 2002; Koch and Stahlecker, 2006).

However, there is conflicting evidence regarding the importance of collaboration with universities, public research institutes and trade organisations for KIBS innovativeness. Djellal and Gallouj (2001) note a negligible role of universities and other public organisations as sources of innovation for KIBS but some studies find that access to scientific and technical knowledge is an important complement to keeping up to date with the actual and potential customers (Mina et al., 2013). Howells (2000) argues that similarities between T-KIBS and high tech manufacturing imply a higher incidence of T-KIBS collaboration with universities relative to P-KIBS. D'Este et al. (2012) find that KIBS firms accounted for 22.7% of collaborative business grants awarded by the UK's Engineering and Physical Science Research Council between 1999 and 2003.

Generally, firms are more likely to source knowledge from both universities and professional networks within their region (Huggins, 2000; Huggins and Johnston, 2010). Universities are increasingly seen as important sources of knowledge (Lawton Smith and Bagchi-Sen, 2006) where emphasis on collaborative initiatives usually rests on the regional level. However, D'Este et al. (2012) find that the successful collaboration with universities actually calls for technological complementarity between partners. Their results imply that the exclusive emphasis on geographic proximity between universities and firms may be misleading. This is because non-spatial proximity conceptualised in terms of similarities between actors based on shared knowledge bases or skills (cognitive proximity) may be more important (Torre and Rallet, 2005; Boschma, 2005; Johnston and Huggins, 2015). In a similar light, Goddard et al. (2012) question the capacity of the university in the North East region to actually foster economic development. Thus, a complex picture emerges where some studies emphasise the importance of geographic proximity between universities and industry but others question the narrow focus on university panacea for regional development.

The involvement of suppliers is generally found to be useful for new service innovation (Tether, 2001; Leiponen, 2005). Cooperation with competitors is seen as another potential source of innovation for KIBS (Tether, 2001; Bryson and Monnoyer, 2004; Leiponen, 2005). However, this type of cooperation may be constrained given the appropriability concerns. In other words, the weakness of Intellectual Property Rights (IPR) protection in services generally may deter KIBS from collaborating with their competitors (Freel, 2006). Also, it is argued that interaction with professional associations may help to relieve the necessity to possess own skills in marketing and launching new service models (Love et al., 2011).

It is pertinent to ask whether it necessarily follows that close geographic proximity to customers or to other sources of complementary knowledge plays an important role for KIBS innovation. A related question is whether there is a role for national or regional governments to bridge possible market failure in networking and knowledge provision in de-industrialised regions? In the UK‘s South East, studies have found support for the importance of specific regional network relations. However, they also emphasise the importance of wider national and international networking for innovation (Keeble et al*.,* 1998; Simmie, 1997; Romijn and Albaladejo, 2002). It follows that empirical evidence from different types of regions is necessary to provide insights into the nature and effect of external knowledge on firms' innovativeness.

Boschma and Lambooy (1999, 21) emphasise that high–technology industries hardly need to establish specific linkages with their local environment in order to develop and expand. This may also hold for KIBS who can develop and expand in any type of region provided they possess sophisticated non-local linkages. However, evidence suggests that although geographical distance can be overcome in multiple ways with help of modern communications technology and better transport connections, long distance service relations are not commonly noted amongst more peripheral KIBS (O’Farrell et al., 1996).

A traditional argument related to KIBS internationalisation has been that KIBS internationalise because their clients operate in foreign markets (O'Farrell et al., 1996). While this type of internationalisation is quite common in KIBS it is by no means the only way for KIBS to reach distant markets. Glucker (2004) and Roberts (1998) state that foreign direct investments (FDI) represent the common form of internationalisation of KIBS but that partnerships are also quite typical due to a need for close KIBS client interaction. FDI type of foreign market entry, however, requires high levels of resources and commitment which most SMEs do not possess. It is more likely that the risks associated with foreign market entry, technology sharing and product/service development, and the barriers posed by foreign regulation, may be overcome by forming joint ventures and strategic alliances. These in turn may have a positive impact on KIBS innovativeness.

In summary, both theory and empirical evidence seem to support the notion that co-operation between firms will have a positive impact upon innovation. However, the empirical evidence related to the relative importance of different types of external linkages remains inconclusive particularly in relation to the role of universities and competitors. Generally, vertical co-operative linkages (with customers and suppliers) appear to be more significant than horizontal linkages (with competitors) (Tomlinson, 2010). And although this finding also applies to KIBS, empirical evidence is required to test this proposition on a sample of KIBS in de-industrialised regions. Further empirical evidence is needed to identify opportunities for KIBS innovativeness by investigating the effect of local and non-local linkages. Evidence based policies supporting innovativeness in KIBS SMEs in de-industrialised regions can then be formulated. Such policies will be directly supporting economic performance in KIBS while simultaneously enhancing the performance of KIBS' clients. Following from the proceeding empirical literature this chapter attempts to answer the following research sub-questions:

5. **Which regional sources of knowledge enhance KIBS' innovativeness?**

6. **Which extra regional sources of knowledge enhance KIBS' innovativeness?**

6.3.2 The role of R&D in KIBS Innovativeness

Even though the scale of R&D activity in KIBS seems to be smaller than in manufacturing (see for example Tether, 2004), Freel (2006) argues that commentators, by and large, continue to support the positive effect of R&D on KIBS innovativeness. Tether (2005), however, finds that while manufacturing firms are more likely to innovate through using in-house R&D and collaborations with universities and research institutes, service firms are more likely to collaborate with customers and suppliers. In the survey of Finnish KIBS firms, Leiponen (2005) found that external knowledge sources especially customers and competitors positively affect innovation, while in-house R&D had no significant effect.

In the study of US business service firms, Mansury and Lowe (2008) find that external linkages have positive effect on a number of measures of innovation performance. Similar results are found on a sample of KIBS in Northern Ireland (Love et al., 2010). Tether and Metcalfe (2004) argue that cooperation with customers and suppliers represents the main source of knowledge and technology for services. According to their findings, these "soft" sources define KIBS' innovation strategy more clearly than traditional "hard" sources such as R&D activity. Leiponen (2012) states that service innovation depends primarily on employee skills and professional knowledge, rather than on narrow (and relatively rarely encountered) set of activities that fall under formalized R&D. Metcalfe (1998) also emphasises the role of knowledge sharing and cooperation for innovation and downplays the role of R&D.

Quantitative analyses based on CIS data show that overall R&D plays less important role in services even though this does not hold true for all services (Evangelista, 2000; Tether, 2003). Some studies emphasise that the degree of similarity between services and manufacturing increases with the level of knowledge intensity so that KIBS will display innovation behaviours similar to those of high technology manufacturing firms

(Hollensten, 2003). In summary, the findings from the previous literature suggest that the role of internal professional knowledge, external openness and linkages are of particular importance in service sector innovation, whereas the role of R&D is less important. This chapter provides empirical evidence regarding both scale and the effect of R&D and external knowledge on KIBS innovativeness in de-industrialised regions in the UK. Hence, the research sub-question this chapter aims to answer is:

7. **How important is R&D for KIBS own innovativeness?**

6.4 The Empirical Specification

6.4.1 Descriptive Statistics

The average size of a sample is 12 employees, and a median is 3 employees. The largest firm employed 249 people. None of the firms are majority owned by another entity. Firms have been operating for an average of 17 years and had an average profit to sales ratio of 4.84%. From 240 companies who recorded information on profits, 47.4% claimed profits above 10% of the turnover and 6% reported zero profits in 2008. From 340 companies who answered the question, 150 (44%) had introduced at least one product/service innovation in the previous three years. From a sample of 339 KIBS who answered the question, 110 (32%) had introduced at least one process innovation and from a sample of 340 respondents, 130 (38%) introduced at least one market innovation.

The survey questionnaire asked business owners and managers to identify how often they source knowledge from various networks located within their region, UK and abroad; whether their firms have introduced innovative products, services, processes and marketing methods in the past three years and how much they invest in R&D. The links between performance indices (innovation) and determining factors (investment in R&D, frequency of sourcing knowledge from various traded and untraded networks) are analysed statistically, although the relationship between innovation and economic performance is outside the scope of this chapter[25]. The emphasis is not on analysing differences or similarities between the two regions but on providing statistically significant results which apply across these two de-industrialised regions.

Turning to the descriptive statistics related to frequency of sourcing external knowledge (Table 6.1), it is interesting to note that the mean scores for co-operation with clients, informal networks and professional and trade organisations are higher than those recorded for co-operation with competitors (horizontal co-operation). This is not surprising as other empirical evidence shows that KIBS are more likely to co-operate with customers and other trading partners along the vertical production chain rather than competitors. The results in Table 6.1 also show that customers and informal contacts are the most frequently utilised sources of external knowledge.

A separate analysis has also been performed in order to compare P-KIBS and T-KIBS with respect to frequency of sourcing knowledge from different sources (not reported in tables). This analysis shows that statistically significant differences for P-KIBS and T-KIBS exist for the following external knowledge sources: Public sector organisations (regional); Professional and trade associations (regional); Business networks (regional); Rival firms (UK based); Public sector organisations (UK based); Professional and trade associations (UK based); Universities (UK based); Business networks (UK based). All the above sources, apart from Professional and trade associations (UK based) are slightly more important for P-KIBS compared to T-KIBS.

6.4.2 The Analytical Model and Variables

The analytical model represents the innovation capability of firms arising from internal inputs, such as their absorptive capacity, and various external inputs. The measurement of innovation relates to product/service innovation and process innovation combined, using a simple binary

[25] Previous research on KIBS in Northern Ireland (Love et al., 2010) shows that the link between innovation, exporting and productivity is complex. Findings from this study indicate that innovation assists both exporting and productivity, however, this link is materialised through formal commitment to R&D whereas innovation *per se* is not enough.

variable indicating whether or not a firm had introduced at least one such innovation during the three years preceding the survey. It should be noted that this measure does not account for the significance or the impact of any particular innovation[26].

The decision to combine product/service and process innovation relies on the previous literature which recognises that the traditional distinction between product/service and process innovation may be less meaningful in services (Love et al., 2010). However, three separate logistic regressions were performed using separate variables of innovation activity namely: (i) product and/or service, (ii) process and (iii) marketing innovation. Results are reported in Appendix V. The regression analysis in Appendix V also includes barriers to success variables in line with previous research on obstacles to innovation in KIBS firms (see for example Amara et al., 2016). However, barriers to success variables do not seem to be important obstacles in the innovation regressions. A single exception is "increased competition faced from companies located outside the region" in relation to marketing innovation (Table V.III). This variable carries a positive sign.

The internal capability or absorptive capacity is measured through investment in R&D. Following Doran and O'Leary (2011), R&D is defined as expenditure by the firm on creative work to increase its stock of knowledge for innovation. Jordan and O'Leary (2008) found that it is the effectiveness of R&D, rather than having a dedicated R&D department, that matters for product innovation. Investment in R&D is measured first as a simple binary variable reflecting whether firms invested in R&D or not and later by three binary variables, reflecting different levels of investment in R&D as a proportion of total turnover: a) investment greater than 10%; b) investment between 6%-10% and c) investment in the range from 1%-5%. Specification of R&D investment measured by three binary variables has also been employed in other studies (see for example, Freel, 2006).

[26] Qualitative information from the survey points to a wide variation in the nature of innovation in firms, some being more radical than others. This information is not captured in a binary variable on innovation.

The external capability of firms is captured through intensity of networking measured by the frequency with which knowledge is sourced from various external sources. [27] These ranged from 1-10 on a Likert scale, representing managers' and business owners' assessments. The variables were classified into regional, national and international sources of knowledge and grouped using Principal component analysis into thirteen significant factors. These 13 factors were applied in the Probit regression models.

The other control variables used in the model include: firm size; firm age; a regional dummy, with 1 for the North East and 0 for West Midlands and also a technology dummy, with 1 for Professional or P- KIBS and 0 for Technology or T- KIBS and. The model is specified below:

$$\Pr(\boldsymbol{y}_i = 1) = X_i\boldsymbol{\beta} + u$$

6.4.3 Analysis Technique

Principal component analysis was used to provide aggregation and normalisation of the external knowledge variables. Its aim was to provide a better understanding of the structure of the set of external knowledge variables and reduce the data to a more manageable size. Thirteen factors with Eigen values greater than 1 were extracted by Varimax rotation and used in regressions. The results are presented in Table 6.2. The description of the factors is provided below. Principal component analysis also tackles the potential problem with co-linearity between various external knowledge sources as well as the problem of systematic measurement error. It is also justified on the grounds that it allows the author to capture the complexity of external knowledge sourcing (by keeping all 51 types of external knowledge sources) but at the same time to systematically classify distinct factors. This is an interesting exploratory

[27] External sources of knowledge were classified into following: Customers, Suppliers, Rival firms, Employment, Licences, Consultants, Formal strategic alliances/joint ventures, Public sector organisations, Private sector organisations, such as private training or research providers and consultants, Literature/patents, Conferences, trade fairs, exhibitions, Professional and trade associations, Universities or other higher education institutes, Contract research, Research cooperation, Business networks, Informal contacts.

analysis which seeks to identify patterns and associations in knowledge sourcing behaviour.

Because the data are self-reported and collected via cross-sectional research design, common method variance may cause systematic measurement error and bias the estimates. To overcome this problem the Principal component factor analysis with Varimax rotation revealed the presence of 13 distinct factors amongst the external knowledge variables. The 13 factors together account for 71% of variance and the first (largest) factor does not account for the majority of variance (the first factor accounts for 21% of variance). Therefore, no single general factor is apparent and it can be concluded that the results are robust.

Description of Factors:

1) *International Formal Knowledge Sources:* These include overseas public sector organisations, consultants, former employment, research cooperation, private sector organisations such as training or research providers, licences, contract research, universities or other higher education institutes, rival firms, professional and trade associations, formal strategic alliances/joint ventures and suppliers.
2) *National Public and Professional Knowledge Infrastructure elsewhere in the UK:* Universities or other higher education institutes, professional and trade associations, business networks.
3) *Regional and National Commercial Networks:* Consultants, both within the local region and elsewhere in the UK; private sector training or research providers and consultants within the region; formal strategic alliances/joint ventures, both elsewhere in the UK and within the region.
4) *International Customer and Informal Networks:* Overseas business networks, conferences, trade fairs exhibitions, customers, informal contacts and formal strategic alliances and joint ventures.
5) *Regional Informal and Business Networks:* Regional business networks, informal contacts, conferences, trade fairs and exhibitions within the region.

6) *Regional and National Research Cooperation:* Contract research and research cooperation.
7) *Regional Public Knowledge Infrastructure* Regional public sector organisations and, Higher education institutes.
8) *Regional and National Patents and Literature.*
9) *Regional and National Customers.*
10) *Regional and National Employees.*
11) *Regional and National Rivals.*
12) *Regional and National Suppliers.*
13) *Regional and National Licences.*

Table 6.2 Principal component analysis results Rotated Component Matrix[a]

	1	2	3	4	5	6	7	8	9	10	11	12	13
Public sector organisations overseas	.850												
Consultants overseas	.799												
Employment overseas	.797												
Research cooperation overseas	.770												
Private sector organisations, such as private training or research providers	.696												
Licences overseas	.681												
Contract research overseas	.677												
Universities or other higher education institutes overseas	.677												
Rival firms overseas	.637												
Professional and trade associations overseas	.592												
Formal strategic alliances/joint ventures overseas	.592			.519									
Suppliers overseas	.492												
Universities or other higher education institutes elsewhere in the		.692											

Professional and trade associations elsewhere in the UK		.626											
Business networks elsewhere in the UK		.575			.552								
Public sector organisations elsewhere in the UK		.494											
Consultants elsewhere in the UK			.720										
Private sector organisations, such as private training or research providers			.692										
Consultants within the region			.642										
Private sector organisations, such as private training or research providers			.629										
Formal strategic alliances/joint ventures within the region			.530										
Formal strategic alliances/joint ventures elsewhere in the UK			.514										
Business networks overseas				.685									
Conferences, trade fairs, exhibitions overseas				.684									
Customers overseas				.589									
Informal contacts overseas				.547									
Literature/patents overseas				.492									

Conferences, trade fairs, exhibitions elsewhere in the UK				.485									
Business networks within the region					.680								
Informal contacts within the region					.644								
Conferences, trade fairs, exhibitions within the region					.644								
Informal contacts elsewhere in the UK					.477								
Professional and trade associations within the region					.461								
Contract research within the region						.848							
Contract research elsewhere in the UK						.815							
Research cooperation within the region						.587							
Research cooperation elsewhere in the UK						.521							
Public sector organisations within the region							.684						
Universities or other higher education institutes within the region							.581						
Literature/patents within the region								.771					
Literature/patents elsewhere in the UK								.650					

Customers elsewhere in the UK									.722				
Customers within the region									.694				
Employment elsewhere in the UK										.776			
Employment within the region										.768			
Rival firms within the region											.824		
Rival firms elsewhere in the UK											.805		
Suppliers within the region												.829	
Suppliers elsewhere in the UK												.715	
Licences elsewhere in the UK													.752
Licences within the region													.607

Notes: Explained variance= 71.057; Kaiser-Meyer-Olkin (KMO) test= 0.819; Bartlett's test of sphericity: X2=9855.969; p=0.000

Regression analysis is performed as the aim is to capture causation i.e. which knowledge sources enhance innovation? Probit regression is appropriate as it is less sensitive to departure from normality in the independent variables. It also allows the dependent variable to take nominal form such as innovation variable in this case. In the Probit estimations, the dependent variable is defined as innovation (i.e. including both product-service and process innovation) and regressed on the following independent variables: (a) the thirteen types of external sources of knowledge identified by the Principal component analysis[28], (b) investment in R&D as measured by three different ranges of the R&D to turnover ratio, and (c) standard control variables usually included in an innovation function.

Tables 6.4 and 6.5 show the results from a Probit model. It needs to be acknowledged that the model is likely to be subject to endogeneity and omitted variables bias. This is because it may be equally plausible that the effect of R&D on innovation may be felt through some unobserved factor such as a general level of firm's success (i.e. it is possible that more innovative firms are also more successful ones, which in turn increases their R&D intensity). This consideration indicates that causation may run in the opposite direction meaning that more innovative firms tend to invest in R&D and not vice versa. To address this issue, sensitivity test is performed by using a two stage estimation that enables to control for any unobserved causality between innovation and R&D.

First, Table 6.4 presents results from one stage estimation in which R&D and innovation are treated as strictly exogenous variables. Table 6.5 presents results from two stage estimation. The best approach to control for unobserved endogeneity is to use instrumental variable estimation. However, the present empirical context does not provide strictly exogenous instruments for R&D[29] and thus two-stage estimation was slightly modified

[28] 13 factors were extracted from the initial number of 51 variables on external knowledge by region, UK and international.

[29] The current data are collected from a telephone survey. Although this method has certain advantages for investigating the importance of external knowledge sources for KIBS innovativeness two main constraints were encountered with regards to implementation of IV estimation. First, none of the variables can be considered as exogenous instruments for R&D and second most of the variables are not continuous which renders them as not suitable for use in IV estimation.

to test the robustness of the results in the presence of unobserved endogeneity. The two stage estimation was implemented as follows: first a Probit model was estimated for the determinants of an R&D active firm. In the first stage estimation, the dependent variable is a binary R&D indicator that takes value 1 if the firm invests in R&D and zero otherwise. In other words, two models were run with Heckman selection regression (Wooldridge, 2009). Similar procedure was adopted by Lee and Cowling (2013) who also estimate latent variable to test for endogeneity.

The results from first stage estimation are shown in column 1 of Table 6.4. Apart from investment in R&D other control variables used at this stage are: region, age, type (P-KIBS vs. T-KIBS) and size. Additionally, different degrees of profitability have been included in order to capture whether or not firms' financial strength may be driving their decision to invest in R&D. Once R&D has been estimated in a Probit model, predicted values of this model are used as regressors in the second stage estimation which is the innovation Probit model. Therefore, the second stage model does not include the trichotomous R&D variable but only the predicted values from the R&D Probit model of the first stage. By following this approach the potential endogeneity effect that might exist between R&D and innovation is reduced. This is another way of saying that selection into the sample of stage 2 is a random process, unaffected by different unobservables. The overall fit of the model as implied from the R-squared value remains low in both Table 6.4 and Table 6.5. This is somewhat an expected outcome given that this is a cross-section analysis with no time variation.

6.5 Main Findings

The survey takes into account geographical remit of various knowledge sources, and the results show that the relationship between “soft” knowledge sources such as interaction and learning from customers, suppliers and other networking partners, on one hand, and “hard” knowledge sources such as R&D, on the other, differ once <u>frequency of interaction</u> and its <u>effect on innovativeness</u> have been taken into account.

The descriptive analysis of the survey shows that the most frequently utilised sources of external knowledge are indeed clients, informal contacts, business networks and suppliers (Table 6.1). However, while higher frequency of networking with regional and UK clients confers innovation advantages this does not seem to apply to interaction with suppliers (Tables 6.4 and 6.5). In fact, more frequent interaction with local and UK suppliers seem to have negative effect on innovation (Tables 6.4 and 6.5).

Hence, in answer to research sub-question 4, it can be concluded that orientation towards local or national client/market exchange is therefore associated with higher innovation performance. This is in line with majority of KIBS studies which emphasise the importance of KIBS-client co-production for innovation. This finding is, however, somewhat contrary to Romijn and Albaladeijo (2002) who found no positive effect of interaction with local customers among high tech firms in the South East of England. Another important result, in terms of both its statistical significance and its positive effect, relates to the influence of regional informal and business networks and attendance at conferences and trade fairs on firms' innovativeness (Tables 6.4 and 6.5). KIBS engagement with various support networks within the region (through informal contacts and business networks), as well as *ad hoc* networking (through conferences, trade fairs and exhibitions) seem to have profoundly positive effect on firms' innovativeness[30].

[30] A caveat should be placed here concerning the causality bias that may exist in relation to the link between external knowledge sources and innovation. The results suggest that the more innovative firms are more likely to take up learning from external sources. Nevertheless, in the current empirical context it is difficult to provide further evidence about the validity of such assumption. This exploration should be left for further empirical research.

Table 6.1 Frequency of sourcing external knowledge (answers reported on a 1-10 Likert Scale)

	N	Mean	Std. Deviation	Std. Error
Customers within the region	**329**	**4.32**	**3.221**	**.178**
Suppliers within the region	**329**	**3.08**	**2.710**	**.149**
Rival firms within the region	330	2.37	2.081	.115
Employment within the region	312	1.92	1.980	.112
Licences within the region	321	1.70	1.682	.094
Consultants within the region	328	2.73	2.365	.131
Formal strategic alliances/joint ventures within the region	329	2.86	2.563	.141
Public sector organisations within the region	329	2.89	2.606	.144
Private sector organisations, such as private training or research providers & consultants	**328**	**3.08**	**2.616**	**.144**
Literature/patents within the region	328	2.88	2.662	.147
Conferences, trade fairs, exhibitions within the region	**330**	**3.09**	**2.501**	**.138**
Professional and trade associations within the region	**329**	**3.48**	**2.817**	**.155**
Universities or other higher education institutes within the region	327	2.60	2.372	.131
Contract research within the region	325	1.58	1.523	.084
Research cooperation within the region	325	1.49	1.400	.078
Business networks within the region	330	2.98	2.637	.145
Informal contacts within the region	**330**	**4.88**	**3.012**	**.166**
UK Sources of External Knowledge				
Customers elsewhere in the UK	**327**	**3.74**	**3.219**	**.178**
Suppliers elsewhere in the UK	329	2.74	2.674	.147
Rival firms elsewhere in the UK	330	2.04	1.930	.106
Employment elsewhere in the UK	317	1.58	1.550	.087
Licences elsewhere in the UK	323	1.58	1.641	.091
Consultants elsewhere in the UK	328	2.10	2.079	.115
Formal strategic alliances/joint ventures elsewhere in the UK	329	2.28	2.378	.131
Public sector organisations elsewhere in the UK	329	2.32	2.368	.131
Private sector organisations, such as private training or research providers & consultants	329	2.45	2.463	.136
Literature/patents elsewhere in the UK	330	2.41	2.538	.140

Conferences, trade fairs, exhibitions elsewhere in the UK	330	2.73	2.496	.137
Professional and trade associations elsewhere in the UK	330	2.84	2.634	.145
Universities or other higher education institutes elsewhere in the UK	329	1.96	1.964	.108
Contract research elsewhere in the UK	329	1.43	1.378	.076
Research cooperation elsewhere in the UK	329	1.40	1.342	.074
Business networks elsewhere in the UK	330	2.25	2.253	.124
Informal contacts elsewhere in the UK	**330**	**3.91**	**3.177**	**.175**
Overseas sources of external knowledge				
Customers overseas	**329**	**1.78**	**2.175**	**.120**
Suppliers overseas	332	1.59	1.859	.102
Rival firms overseas	332	1.23	1.116	.061
Employment overseas	328	1.10	.745	.041
Licences overseas	329	1.16	.980	.054
Consultants overseas	331	1.17	.938	.052
Formal strategic alliances/joint ventures overseas	330	1.34	1.469	.081
Public sector organisations overseas	330	1.13	.794	.044
Private sector organisations, such as private training or research providers and consultants	329	1.24	1.138	.063
Literature/patents overseas	331	1.44	1.660	.091
Conferences, trade fairs, exhibitions overseas	332	1.54	1.810	.099
Professional and trade associations overseas	332	1.33	1.359	.075
Universities or other higher education institutes overseas	330	1.16	.882	.049
Contract research overseas	331	1.15	.968	.053
Research cooperation overseas	330	1.14	.853	.047
Business networks overseas	332	1.25	1.166	.064
Informal contacts overseas	**331**	**1.68**	**2.061**	**.113**

The descriptive data (Table 6.1) support findings from previous studies (see for example, O'Farrell et al*.,* 1996) which indicate that for KIBS, international networks are much less common than regional and UK networks. However, the more KIBS engage in networking with international informal contacts, strategic alliances and joint ventures, attend conferences, trade fairs and exhibitions overseas and interact with foreign customers, the probability that they had introduced product/service/process innovation increases (Tables 6.4 and 6.5). The positive effect of engaging with international clients suggests that those KIBS who establish international exporting capabilities tend to benefit from more sophisticated international demand. This finding is in line with Romijn and Albaladeio (2002) who found that most innovative high tech firms located in the South East operate in leading global markets. Thus, in answer to research sub-question 6, it can be concluded that it is not export orientation *per se* but learning through exporting, as proxied by frequency of interaction with international clients and market entry through joint ventures and strategic alliances, that significantly increases innovation capability (Tables 6.4 and 6.5).

Innovation capabilities of KIBS SMEs do not seem to be enhanced by frequency of interaction with firms in similar line of business (Tables 64. and 6.5). This finding is consistent with Tomlinson (2010) who found that horizontal co-operation between firms does not appear to be significant in explaining innovation. However, more frequent interactions with the regional and national commercial networks, such as consultants and commercial training providers are significant predictors of KIBS innovation activity. Moreover, more intensive collaboration with national and regional universities and public sector organisations actually decreases the probability of innovation in the first model (Table 6.4).

Other studies that report similar results state that this negative association may be due to KIBS SMEs attempting to overcome competitive pressures by reaching out to universities and public sector organisations (Keeble et al., 1998; Huggins and Johnston, 2009). The positive role of non-local collaboration with universities is in line with D'Este and Iammarino (2009) who noted that firms seek most suitable university partners who are often not located in the same region. Similarly, Johnston and Huggins (2015) also find that university-industry collaboration is positively influenced by the participation of firms with fewer than 10 employees, an urban location and the density of KIBS in the region. Johnston and Huggins (2015) suggest that one size fits all model should be avoided in encouraging the development of collaborative links between KIBS and universities.

However, once the possible effect of firms' general level of success in the two stage model has been controlled for, this significant and negative effect seizes to exist and instead becomes positive but insignificant for regional public networks. For national public and professional knowledge infrastructure (universities and other higher education institutes, professional and trade associations and business networks) the sign in the two stage model is both positive and significant. Hence, the role of national public and professional knowledge infrastructure becomes a significant predictor of firms' innovativeness once the control for the general level of firms' success has been introduced. This effect, as noted above, does not apply for regional public knowledge infrastructure (regional public sector organisations and regional universities) even though the positive sign in the two stage model is acknowledged.

Only a small proportion (14.6%) of the North East and the West Midlands KIBS SMEs invested in R&D. The role of R&D in supporting KIBS innovation seems nevertheless both significant and positive in the first model. This effect applies to all levels of R&D expenditure (Table 6.4). This result holds true for both technological and professional KIBS (P-KIBS/T-KIBS dummy controls are introduced in both regressions). This is in line with some other recent studies which apply an innovation production function to establish the sources of KIBS innovativeness (see for example Freel, 2006; Love and Mansury, 2007; Love et al., 2010).

However, once control for endogeneity has been implemented, investment in R&D seizes to remain the significant predictor of innovation although the positive sign for R&D remains (column 2, Table 6.5). This result does indicate that the R&D innovation nexus is subject to endogeneity bias. In answer to research sub-question 7, it <u>cannot</u> be concluded that R&D does not matter for innovation but the results indicate that there are also some other/unobserved factors which are associated with innovation which work in combination with various sources of external knowledge. This finding is in line with Freel (2003) who was unable to find a significant relationship between R&D and product innovation in the science based sector. It is also in line with Tomlinson (2010) who did not find a significant positive effect of R&D on product innovation in five industrial sectors.

In the second model, innovation also seems to depend on a firm size, with large firms more likely to introduce innovation. This finding is in line with previous studies, including Roper et al., (2008). Extensive knowledge sourcing from regional and national licences also improves innovation capability (Tables 6.4 and 6.5). Licensing essentially permits the firm to use the property of the licensor, usually in the form of trademarks, patents and production techniques. Licensing has the potential for large return on investment due to a low initial investment required by the licensor, though some potential returns from manufacturing and marketing may be lost. However, it seems that benefits which KIBS SMEs accrue from licensing arrangements in both case study regions outweigh the associated disadvantages, at least in the short term.

Also, the probability of being an innovator increases for firms located in the West Midlands rather than those who are located in the North East. In the first model P-KIBS are more likely to be innovators but once the control for the general level of firms' success is introduced this effect does not exist any longer, even though it should be noted that the sign stays positive. To test for any possible sectoral effect, separate regression analysis was performed (not reported) which includes KIBS sub-sectoral dummies but no significant differences were observed.

Separate regression analysis was performed for T-KIBS and P-KIBS (not reported in tables). The results for P-KIBS show that the significant and positive contribution to innovation comes from the National public infrastructure including universities, International customers and informal contacts and investment in R&D. The results for T-KIBS show that the significant and positive contribution to innovation comes from Regional informal networks, Regional and national licences and investment in R&D. Regional and national research collaboration carries significant but negative sign for T-KIBS.

Table 6.3 Correlation Matrix Innovation, R&D and firm specific Characteristics

	Innovation	Region	Age	Size	P-KIBS/ T-KIBS	R&D	RD>10	6<R&D <10	1<R&D <5
Innovation	1								
Region	-0.061	1							
Age	-0.001	0.09	1						
Size	0.161	0.048	0.295	1					
P-KIBS/T-KIBS	0.086	-0.002	-0.056	0.006	1				
R&D	0.221	0.037	0.021	0.242	-0.014	1			
RD>10	0.174	-0.052	-0.054	0.251	-0.154	0.67	1		
6<R&D<10	0.136	0.11	-0.038	-0.044	0.017	0.49	-0.075	1	
1<R&D<5	0.027	0.027	0.161	0.157	0.18	0.432	-0.066	-0.049	1

Table 6.4 Determinants of Innovation, Results from Probit Estimation

VARIABLES, **Pr(Y=1, innovation and 0 otherwise)**	Marginal Effects	Marginal Effects
Region	-0.080***	-0.099***
	[0.017]	[0.001]
Age	0	0
	[0.002]	[0.001]
Size	0.003	0.004
	[0.003]	[0.002]
P- KIBS vs. T- KIBS	0.034***	0.037***
	[0.009]	[0.006]
R&D(1=R&D active, 0=R&D inactive)	0.259***	
	[0.008]	
R&D Expenditure>10%		0.260***
		[0.007]
R&D Expenditure 6-10%		0.375***
		[0.041]
R&D Expenditure 1-5%		0.031***
		[0.007]
International Formal Knowledge Sources	-0.047***	-0.043***
	[0.014]	[0.001]
National Public and Professional Knowledge Infrastructure	-0.016***	-0.015
	[0.003]	[0.012]
Regional and National Commercial Networks	0.069*	0.066
	[0.041]	[0.043]
International Customers and Informal Networks	0.044***	0.034***
	[0.008]	[0.007]
Regional Informal and Business Networks	0.132***	0.139***
	[0.026]	[0.031]
Regional and National Research Cooperation	-0.037***	-0.036***
	[0.002]	[0.012]
Regional Public Knowledge Infrastructure	-0.037	-0.038
	[0.047]	[0.083]
Regional and National Patents and Literature	0.001	0.005
	[0.009]	[0.012]
Regional and National Customers	0.056***	0.062***
	[0.006]	[0.003]
Regional and National Employees	-0.025	-0.026
	[0.083]	[0.081]
Regional and National Competitors	0.006	0.007
	[0.027]	[0.042]
Regional and National Suppliers	-0.036	-0.039
	[0.037]	[0.044]
Regional and National Licences	0.025***	0.027***
	[0.004]	[0.003]
Observations	237	235
Probability of positive outcome (Y=1)	0.565	0.569
Pseudo R-squared	0.128	0.14
Log-likelihood	-142.4	-139.3

Notes: Robust standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1

Table 6.5 Two Stages Probit Estimation for Innovation

	R&D	Innovation
	Marginal	Marginal
Region	0.029***	-0.093***
	[0.007]	[0.005]
Age	0	0
	[0.001]	[0.001]
P-KIBS vs. T-KIBS	0.02	0.003
	[0.059]	[0.003]
Size	0.002**	0.033
	[0.001]	[0.050]
Profitability 0	0.187	
	[0.541]	
Profitability 0-1	0.594**	
	[0.240]	
Profitability 2-5	0.438***	
	[0.087]	
Profitability 6-10	0.539***	
	[0.118]	
Profitability>10	0.160**	
	[0.081]	
R&D predicted values		0.081
		[0.087]
International Formal Knowledge Sources		-0.037***
		[0.002]
National Public and Professional Knowledge Infrastructure		0.039***
		[0.006]
Regional and National Commercial Networks		0.102*
		[0.058]
International Customers and Informal Networks		0.044**
		[0.018]
Regional Informal and Business Networks		0.129***
		[0.025]
Regional and National Research Cooperation		-0.040***
		[0.007]
Regional Public Knowledge Infrastructure		0.001
		[0.031]
Regional and National Patents and Literature		0.023
		[0.020]
Regional and National Customers		0.058***
		[0.013]
Regional and National Employees		-0.045
		[0.091]
Regional and National Competitors		0.023
		[0.034]
Regional and National Suppliers		-0.011***
		[0.000]
Regional and National Licences		0.028*
		[0.016]
Observations	267	296
Probability of positive outcome	0.156	0.568
Pseudo R-squared	0.154	0.115
Log-likelihood	-108.9	-180.4

Note1: Standard errors in brackets with *** p<0.01, ** p<0.05, * p<0.1. Estimates refer to a two stage procedure. In the first stage, the probability of firm to invest in R&D is estimated. In the second stage, predicted values of the R&D equation are used as the determinant in the innovation decision equation. Further details about the two stage estimation can be found in the text.
Note2: Number of observations in the first stage is lower due to a number of firms who did not answer the profitability question.

6.6 Conclusion

This chapter has sought to analyse whether any particular knowledge networks may be conducive for KIBS SMEs innovativeness as well as to establish the geographical remit of these networks. This chapter has also investigated the role of R&D in KIBS innovativeness. The main empirical contribution of this chapter and its novelty lie in the fact that this is empirical research regarding KIBS innovation which takes into account both the diversity of the types of knowledge links as well as the level of localization of these links. At the same time, the chapter contributes to the territorial innovation literature by providing insights into the diversity of types of external knowledge and the level of their localisation in de-industrialised regions. It has been shown that KIBS SMEs who establish more frequent specific linkages both with their local as well as global environments are more likely to be innovative. A positive (though not significant) effect of R&D on KIBS innovativeness is also acknowledged.

A fundamental dilemma in the economic geography discourse concerns the question whether places are more relevant for the competitiveness of firms or whether networks matter more (Castells, 1996). In a nutshell, the cluster literature claims that regions are drivers of innovation and economic development because tacit knowledge travels more easily over shorter rather than longer distances. Cluster borders were conceived to enclose knowledge networks and collective learning processes within the place of the cluster (Ter Wal and Boschma, 2009). Similarly, agglomeration economies literature and cluster literature overlook the possibility that new knowledge may flow into the region through extra-local linkages (Ter Val and Boschma, 2009). This is how sectoral lock-in may be overcome by the inflow of high variety of knowledge transferred via inter-regional sources.

Network theory suggests that knowledge networks are not necessarily territorial but social constructs that may cross regional boundaries. Nevertheless, geographical proximity may affect the network structure and certain types of networks may be more spatially bounded. Social proximity may be a driver of network formation (Granovetter, 1973) and there is higher probability that firms will connect to individuals and other firms with whom they are also socially connected (Sorensen, 2004). The results show that for KIBS in de-industrialised regions informal networks are important and that they transcend geographical boundaries (Table 6.1).

For some time UK SME policy has focused on building clusters of related firms. This initiative has mainly taken a form of building physical infrastructure such as science parks (Huggins et al., 2010). Science parks have been largely created to promote linkages with scientific institutions and universities located close to industry. This policy direction draws its authority mainly from localised learning and cluster literature. However, the results indicate that, for KIBS SMEs, benefits associated with more frequent interaction with firms in a similar line of business are not evident. In addition, relationships with scientific institutions and universities seem to benefit firms from a distance rather than locally. The latter finding is in line with some recent studies that also question the importance of geographic proximity of university-industry ties (see for example D'Este and Iammarino, 2010; D'Este et al. 2012; Johnston and Huggins, 2015).

The results also show that both regional and international networks are conducive of firms' innovativeness in de-industrialised regions. These results correspond to previous findings from developed regions which point to the importance of both local and global ties (see for example Simmie, 1997; Keeble et al., 1998; Romijn and Albaladeijo, 2002). In addition, being an exporter and learning from international clients increases the chance of success but so does learning from local and UK customers. Local and UK consultants also play a positive role. Bearing in mind the positive role of external informal contacts and business networks (both regional and global) the role of firms' internal R&D and their corresponding absorptive capacity should not be underestimated. Engagement in business and informal networking, attending business meetings, conferences and fairs, all seem to have a positive effect as long as there is enough internal capacity to absorb knowledge and information available elsewhere.

In the survey, some institutions, such as the Chambers of Commerce, Business Link, the professional trade organisations, the former

Regional Development Agencies and other regional and industry specific business networks, were listed as important networking partners, providing consultancy and financial assistance and facilitating networking between firms and other organisations. In this respect they play important role in de-industrialised regions as sources of knowledge for KIBS SMEs. This may well mean that in de-industrialised regions they act to ameliorate possible market failures related to insufficient provision of commercial support for SMEs. Their impact should therefore be viewed not only through their direct role in providing business, marketing and financial assistance to firms but also through their role as mediators between KIBS SMEs and local and international business networks and potential distant markets.

From a methodological viewpoint, the current analysis provides a novel and original quantitative evidence related to important characteristics of external knowledge sourcing on a sample of KIBS SMEs located in de-industrialised regions. However, there are a number of limitations. These include the utilisation of a binary response in the definition of dependent variables. A number of other studies (see for example Jordan and O'Leary, 2005; Roper et al*.,* 2008; Doran and O'Leary, 2011) have suggested that this may tend to overstate the importance of external interactions.

Also, cross-sectional analysis does not allow a researcher to claim the direction of causality without the assistance of panel data. However, this problem is tackled with two-stage estimation in the second model in relation to the effect of R&D. It should be emphasised, therefore, that important line of future enquiry must include an attempt at disentangling the relationships between the internal capability and external interactions of firms. Further, empirical evidence from both de-industrialised and core regions are needed in order to enhance reliability of the current results.

It is acknowledged in the next chapter that, far from representing a homogenous group, KIBS are comprised of separate sub-sectors underpinned by differentiated knowledge bases. Insights from the regional systems of innovation and differentiated knowledge bases literature provide useful perspectives on KIBS sub-sectoral specialisation. For the purpose of this particular analysis KIBS sub-sectors in Chapter 7 are divided into: Computer and related; Engineering, architecture and urban planning; Management consultancy; R&D and technical testing and Advertising and publishing services.

CHAPTER 7: KIBS SUB-SECTORS AND DIFFERENTIATED KNOWLEDGE BASES

7.1 Introduction

In this chapter the interest is placed on the characteristics of KIBS sub-sectors. The aim is to establish to what extent can KIBS sub-sectors be differentiated according to their respective (i) innovative inputs such as knowledge bases and investment in R&D and (ii) innovative outputs such as type of innovation? **The main research question this chapter seeks to answer is: How do different KIBS sub-sectors differ in their role as facilitators of knowledge across space?** The conceptual framework adopted in this chapter is to establish KIBS role as facilitators of knowledge across space by differentiating KIBS sub-sectors according to specific knowledge taxonomy and at the same time testing whether certain assumptions related to geographic proximity apply to these. The findings indicate that the original classification proposed by Miles et al. (1995), which separates Technology based KIBS (T-KIBS) and Professional KIBS (P-KIBS) seem insufficient to account for the diversity of knowledge bases associated with different types of KIBS.

A number of researchers have emphasised that KIBS literature largely portraits KIBS as a homogeneous group of activities (Hertog and Bilderbeek, 2000; Tether, 2005; Consoli and Elche-Hortelano, 2010; Tether et al. 2012; Pina and Tether, 2016). Tether et al. (2012) note that several recent quantitative studies on KIBS and geography of innovation either treat KIBS as one industry (see for example Doloreux and Shearmur, 2012) or apply a simple distinction to T-KIBS and P-KIBS.

A body of qualitative literature on KIBS or producer services focuses on the variation within, rather than between them (Tether et al., 2012). This literature investigates the role of institutions in internationalisation and globalisation and the significance of global cities (see for example Beaverstock et al., 1999; Beaverstock, 2004; Faulconbridge, 2006, 2007, 2008, 2009; Beaverstock et al., 2010). Tether et al. (2012) further note that even though much has been learned about KIBS, one question which remains largely unexplored is to what extent are KIBS an “industry” or a “sector"? Should they be divided along relatively simple lines, for example between technology producing T-KIBS and professional P-KIBS and to what extent can different KIBS sub-sectors be differentiated?

Rather than treating KIBS as a single group or focusing on internationalisation practices of a particular KIBS group, analysis in this chapter aims to establish specific features which differentiate KIBS sub-sectors using knowledge bases taxonomy as developed by Asheim and Coenen (2005). Previous studies proposed that Computer and related firms are associated with analytic knowledge, Engineers and Architects are oriented towards synthetic knowledge, Advertisers and Publishers mainly draw from symbolic knowledge (hence not likely to be associated with either analytic nor symbolic knowledge), whereas Management consultants are expected to resemble features of synthetic knowledge base. R&D firms are expected to be clearly associated with analytic knowledge base.

This classification relates to Polanyi’s (1967) distinction between tacit and codified knowledge. It has been argued that there is typically a connection between the type of product, the technologies of production and the organisation of production in manufacturing, whereas a significant and meaningful variety dimension amongst KIBS is the type of knowledge central to their activities (Pina and Tether, 2016). Moreover, it is acknowledged in this chapter that KIBS services may differ in their utilisation of different types of knowledge but also in their propensity to innovate and invest in R&D.

The rest of the chapter is structured as follows. In section 7.2 the literature on KIBS and knowledge bases is discussed. This section proposes a conceptual framework applied in the analysis of the KIBS survey results. Section 7.3 outlines measures and methods used to examine different knowledge bases and other characteristics, including firms’ innovative performance. Section 7.4 discuses main findings and section 7.5 concludes the chapter with a summary of the contribution and some considerations for further research.

7.2 The Conceptual Framework

7.2.1 KIBS-Sectorial Perspective

The empirical research on sectoral patterns of innovation investigating characteristics of the innovative processes in particular industries as well as cross-sectoral differences in technological activities and performance has proliferated in the recent past (Castellacci, 2007). One group of studies have investigated sector-specific technological regimes and implications for market structure and industrial dynamics (see for example Breschi and Malerba, 1997; Breschi et al., 2000; Malerba, 2002). The literature on sectoral systems of innovation acknowledges that sectors exhibit some common features within but also some notable differences (see for example Malerba, 2002; Malerba, 2005). Malerba (2002) emphasises the interplay between the knowledge base of a sector, its innovation and implications for the development of new trajectories. Most of related work on sectoral systems of innovation is restricted to manufacturing industry.

Another group of studies, rather than focusing on particular industries and their dynamics, investigate differences between innovative strategies and technological trajectories[31] among different sectors (see for example Pavitt, 1984). Following in this tradition, a well-established paradigm-regime-trajectory model that was previously developed for the study of innovation in manufacturing has been adopted by services innovation scholars. One such model the Freeman-Pavitt-Dosi model is particularly well known (Pavitt, 1984; Dosi, 1988; Freeman and Soete, 1997). This model differentiates between scale-intensive; supplier-dominated and knowledge-intensive industries as well as manufacturers[32].

It is only more recently that the innovation typology was developed by Miozzo and Soete (2001) with the purpose of studying services exclusively. This typology extends Pavitt's taxonomy and differentiates between supplier dominated sectors such as public and collective services;

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[31] According to Pavitt (1984) different trajectories can be explained by sectoral differences in: sources of technology, users' needs and means of appropriating benefits.

[32] An overview of different innovation typologies and taxonomies for service industries have been provided by Evangelista and Savona (1998), Miles (2002), Tether and Hipp (2000), amongst others.

production intensive sectors such as large scale back office administrative tasks; physical network sectors such as transport and specialist technology suppliers such software science based services.

The first KIBS paper to acknowledge sectoral separation between technology-intensive services (T-KIBS) and traditional business and management consulting activities, or professional services (P-KIBS) is that authored by Miles et al. (1995). Ever since a number of empirical KIBS studies support the heterogeneous nature of KIBS and show that KIBS sectors feature differential sub-sectoral specialization (see for example Antonelli, 1998; Muller and Zenker, 2001; Tether, 2003; Hollenstein, 2003; Hipp and Group, 2005; Freel, 2006; Zenker and Doloreux, 2008; Corrocher et al., 2009; Pina and Tether, 2016). However, empirical studies relating to types of knowledge exchange between KIBS and other actors in innovation system are rare with the few notable exceptions (see for example Leiponen, 2005; Aslesen and Isaksen, 2010; Amara et al., 2010).

Strambach (2008) notes that, in comparison to manufacturing approaching KIBS from an “industry” perspective is not common. This is because industries are characterised by the division of labour and use of particular production methods, neither which is very pronounced in KIBS (Strambach, 2008). There is also a lack of research which provides systematic analysis of specific knowledge bases and their influence on knowledge processes in KIBS (Strambach, 2008). Generally, researchers have been reluctant to acknowledge that KIBS represent an industrial sector(s). Pina and Tether (2016) emphasise that this shortcoming is largely related to the fact that researchers and policy makers have been mostly concerned with understanding how KIBS differ from product-based manufacturing and have as a result treated KIBS as a homogenous group. The aim was to differentiate KIBS from other types of firms or industries, thus most studies have considered KIBS as a whole (Pina and Tether, 2016, 401).

There are different analytical routes which enable analysis of industries and sectors. These can be separated according to the output they produce (products and innovation for example) or the inputs they use (labour, capital, intermediate inputs and knowledge) (Consoli and Elche-

Hortelano, 2010). In an input-based analysis of KIBS, accounting for different types of knowledge that make up occupations, activities and sectors is of paramount importance (Consoli and Elche-Hortelano, 2010). This study follows in line with Pina and Tether (2016) and applies differentiated knowledge bases taxonomy to KIBS. It also extends Pina and Tether (2016) by taking into consideration how different KIBS sub-sectors can be differentiated by the nature of their innovation input (i.e. investment in R&D) and innovation output (i.e. different types of innovation).

7.2.2 Applying Differentiated Knowledge Bases to KIBS

Literature on differential knowledge bases separates analytic, synthetic and symbolic knowledge (Asheim and Gertler, 2005; Asheim et al., 2007). Drawing from Polanyi's (1967) distinction between tacit and codified knowledge it is believed that synthetic and symbolic knowledge, due to their greater tacit properties, require closer geographic proximity, whereas analytic knowledge travels further distances. This is because analytic knowledge is more codified and transferrable whereas synthetic and symbolic knowledge are more personalised and articulated through practice and skills. They are accumulated through experience and for their meaning depend largely on the institutional context. In practice, most activities comprise of more than one knowledge base and the degree to which a certain knowledge base prevails varies between industries, firms and different types of activities and occupations (Asheim and Hansen, 2009).

Asheim and Gertler (2005) note that analytical knowledge base is dominant in economic activities where scientific knowledge is important and where knowledge creation is mainly based on formal models, codified science and rational processes. Analytical knowledge is more codifiable and geared towards understanding and explaining features of the natural world (Tether et al., 2012, 7). Examples mentioned in the literature include genetics, biotechnology, information technology and life science industry. For those industries, basic and applied research is relevant. Companies usually run their own research and development (R&D) departments, but rely also on knowledge generated at universities and other research organisations as an input to their innovation activities (Martin and Moodysson, 2011).

Synthetic industries deal to a certain extent with codified knowledge, which is less context specific, although the dominating form is still tacit. Synthetic knowledge is experiential, oriented towards solving problems in the human world (Tether et al., 2012, 7). Synthetic knowledge base prevails in industries that create innovation through use and new combination of existing knowledge, with the intention to solve concrete practical problems (Asheim and Gertler 2005; Asheim et al., 2011). Synthetic knowledge is often applied during user-producer interactions in order to solve context specific problems (Tether and Metcalfe, 2003). Examples mentioned in the literature are plant engineering, specialized industrial machinery and shipbuilding.

The symbolic knowledge base is a third category that has been introduced more recently to account for the growing importance of cultural mode of production particularly in cities (see for example Scott, 1997; Asheim et al., 2007). Engagement in this type of knowledge requires artistic abilities in symbol creation whereas knowledge is produced and transmitted through aesthetic and cultural products such as sounds, images, artefacts (Tether et al., 2012, 8). It is strongly present within industries such as film, television, publishing, music, fashion, architecture and design where innovation is dedicated to the generation of aesthetic value and images and less to a physical production process (Asheim et al., 2007). Symbolic knowledge can be embedded in material goods such as clothing or furniture, but its impact on consumers and its economic value arises from its intangible character, i.e. its aesthetic quality (Martin and Moodysson, 2011, 6).

Strambach (2008) argues that within the KIBS sector, technical engineering KIBS make a relatively heavy use of synthetic knowledge. Here, new knowledge is generated only partly through deduction and abstraction, but primarily through induction, encompassing the process of testing, experimentation and practical work (Martin and Moodysson, 2011, 6). Tacit knowledge is relatively more important than for science R&D

(which involves deductive experimental science and research activities) and this is due to inductive way of knowledge creation through new combination of existing knowledge parts based on experiences in learning by doing, using and interacting (DUI) processes (Jensen et al., 2007). All this is with the aim of solving user specific problems (Strambach, 2008).

It follows that cooperation and knowledge exchange in Engineering KIBS should occur more often between spatially co-located partners. It may also be assumed that compared to direct monitoring of competition which is an inferior strategy for sourcing tacit knowledge, staff recruitment is expected to be a crucial strategy for knowledge sourcing. Also, when using less formalised channels Engineering KIBS are expected to use largely industry-specific ones such as business networks. For Engineers, formal R&D activities are of minor importance, linkages between university and industry are expected to be less relevant compared to R&D sector.

Symbolic knowledge includes forms of knowledge applied and created in KIBS industries such as advertising, design and publishing. Since these industries often organize their activities within short-term projects, knowledge about possible partners for cooperation and knowledge exchange (know-who) is of considerable importance (Martin and Moodysson, 2011, 6). Symbolic knowledge is highly context-specific (Asheim et al., 2011), as the interpretation of symbols, images, designs, stories and cultural artefacts "*is strongly tied to a deep understanding of the habits and norms and everyday culture of specific social groupings"* (Asheim et al., 2007, 664). As Gertler (2008) points out, the symbolic knowledge embedded within industries such as advertising has been shown to be very highly shaped by its social and cultural context. Therefore, the meaning and the value associated with symbolic knowledge vary considerably between places (Martin and Moodysson, 2011, 6).

It follows that Advertisers and Publishers are expected to rely predominantly on knowledge sources situated in geographical proximity, since the interpretation of the knowledge they deal with tends to vary between places. Formalised knowledge sources related to academia are expected to be less important, since product and process development is driven by context-specific creative solutions rather than application of scientific laws. In this case creativity and artistic skills are paramount to competitiveness. Because such capacities are hard to transfer from one individual to another, staff recruitment should be an important strategy for knowledge sourcing (Martin and Moodysson, 2011).

As artistic skills are strongly context dependent, not only with regards to geography but also to the type of activity, firms in the same industry, within the same country will be important source of knowledge. Because many of these companies build their image and brand name around their core products, their innovations are usually not kept secret but distributed in as wide channels as possible (Martin and Moodysson, 2011). This implies that monitoring of other firms through channels such as trade fairs and exhibitions is important strategy for knowledge sourcing.

In contrast to Engineering firms there is substantial literature on Architects and the geography of their practices (Tether et al., 2012). This literature is largely qualitative and tends to focus on global practices and “starchitects” (see for example Faulconbridge, 2010). However, most architectural practices are not globalised and this literature provides somewhat distorted view of architects with regards to the extent of their globalisation (Tether et al., 2012). Thus, results from the North East and the West Midlands survey provide unique empirical evidence in relation to characteristics of architectural practices located away from the major metropolitan regions. These architects are expected to operate on a more parochial scale as opposed to their metropolitan counterparts in London who extensively participate their respective communities of practice (Wenger, 1988). Many architectural practices in metropolitan regions rely on face-to-face interaction but are connected to global constellations of practice.

Strambach (2008, 8) further argues that architectural services exemplify how closely technical engineering knowledge and symbolic knowledge are intertwined and that same applies for management consultancy and software services. This particularly applies to Architects in the two chosen case study regions as they are expected to share many similarities with the Engineering KIBS with regards to their knowledge sourcing practices. For this reason, Engineers and Architects are studied as a single group in this chapter. An important acknowledgement is that knowledge sourcing practices in any individual KIBS sub-sector may straddle categories of the knowledge taxonomy.

An important issue is related to the extent to which different KIBS sub-sectors choose their location differently. Following Christaller's (1933) proposed hierarchy, it is expected that higher order KIBS will locate in cities whereas lower order ones will be more dispersed. The important question is to what extent this applies to KIBS uniformly? Von Nordenflycht (2010) differentiates between regulated professional KIBS such as Architects and Engineering firms on one hand and non-regulated KIBS such as Management consultants and Advertisers on the other. The lack of national regulatory standards is perceived as enabling factor in KIBS internationalisation (see for example Jones, 2003; Faulconbridge et al., 2011). This implies that certain KIBS sub-groups such as Management consultants and Advertisers and Publishers will be traded more widely compared to other KIBS.

It has been noted that traditional professions with client relations are nationally regulated and this can be compared to financial regulation but most professional KIBS are themselves subject to external, non-regulatory supervision, i.e. training and codes of practice (Wood and Wojcik, 2010). Nevertheless, lack of formal regulation may enable certain KIBS to reach global markets from core city locations, which provide access to global markets and global communities of practice. Following from the above literature below listed research sub-questions will be answered in this chapter:

8. **Do Computer and related and R&D KIBS resemble characteristics of analytic knowledge base?**

9. **Do Engineering and Architecture KIBS and Management Consultants resemble characteristics of synthetic knowledge base?**

10. **Do Advertisers and Publishers differ from synthetic and analytic knowledge base?**

The main empirical challenge is how to identify and measure knowledge bases (Pina and Tether, 2016). So far, Asheim and colleagues' model has been applied in a few in-depth case studies (see for example Strambach and Dieterich, 2011) or with regions and industries as the level of analysis (see for example Asheim and Coenen, 2005; Moodysson et al., 2008; Coenen and Moodysson, 2009) or using occupations as basic level of analysis (see for example Martin, 2012; Tether et al., 2012). This study uses individual firm as the level of analysis whereby the importance that individual firms assign to various external sources of knowledge and their geographies are related to different knowledge bases.

Table 7.1 provides summary of the expectations for the knowledge bases based on the external knowledge sourcing practices of firms. Table 7.1 shows that analytic knowledge base is associated with more frequent knowledge sourcing from: suppliers, licences, literature and patents, universities, contract research and research cooperation and rival firms. Synthetic knowledge base is associated with external knowledge sourcing from: customers, strategic alliances and joint ventures, conferences and trade fairs, business networks and informal contacts. This categorisation is used to classify different KIBS sub-sectors to their respective knowledge bases in later analysis in this chapter.

Table 7.1 Typology of knowledge bases classified by the type of external knowledge source

Knowledge Base	External knowledge source	Literature/Assumptions
Analytic		
Predominantly codified and scientific	Suppliers	
Innovation creation by new knowledge	Licences	Tether and Metcalfe, 2003
Travels further distances	Literature and Patents	Asheim et al., 2007
		Faulconbridge et al., 2011
		Tether et al., 2012
		Tether and Metcalfe, 2003
	Universities	Asheim et al., 2007
		Faulconbridge et al., 2011
		Tether et al., 2012
	Contract Research	Asheim and Coenen, 2005
	Research Cooperation	Asheim and Coenen, 2005
	Rival firms	Martin and Moodysson, 2011
Synthetic		
Predominantly tacit and applied	Customers	Asheim el al., 2011
Innovation creation by applying existing knowledge	Strategic Alliances and joint ventures	
More localised	Conferences and trade fairs	
	Business Networks	
	Informal Contacts	

7.3 The Empirical Specification

7.3.1 Descriptive Analysis

Table 7.2 shows correlations between KIBS sub-sectors and firm size; urban vs. town or rural location; investment in R&D; and different types of innovation in products or services, processes and marketing. Spearman correlation is used as most variables are not normally distributed. Information in Table 7.2 shows that Advertisers and Publishers tend to be larger firms; Computer and related KIBS are associated with product/service innovation; Architects and Engineers are less likely to be product/service innovators and are less likely to invest in R&D; whereas Management consultants are more likely to have introduced marketing innovation in the past three years. Firms in the R&D category are defined by the higher proportion of firms who have invested in R&D.

Table 7.2 Characteristics of KIBS sub-sectors

		Computer and related	Engineering and Architecture	Management Consultants	Advertising and Publishing	R&D
Number of employees	Correlation Coefficient	-.006	-.044	-.060	**.117***	.032
	Sig. (2-tailed)	.907	.422	.270	.031	.559
	N	342	342	342	342	342
Location City vs. Rest	Correlation Coefficient	.002	.020	-.056	.057	-.028
	Sig. (2-tailed)	.963	.709	.304	.292	.605
	N	342	342	342	342	342
Investing in R&D	Correlation Coefficient	.035	**-.140***	-.019	.011	**.283****
	Sig. (2-tailed)	.571	.022	.757	.860	.000
	N	270	270	270	270	270
Product or Service Innovation	Correlation Coefficient	**.124***	**-.257****	.065	.100	.021
	Sig. (2-tailed)	.022	.000	.234	.065	.705
	N	340	340	340	340	340
Process Innovation	Correlation Coefficient	-.015	.046	.013	-.048	.028
	Sig. (2-tailed)	.789	.397	.805	.381	.606
	N	339	339	339	339	339
Marketing Innovation	Correlation Coefficient	-.056	-.007	**.117***	-.060	-.030
	Sig. (2-tailed)	.304	.899	.032	.268	.583
	N	339	339	339	339	339

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Respondents were asked to rate the frequency of sourcing various types of external knowledge and to match their answers on a 1-10 point Likert scale. External sources of knowledge were classified into the following: Customers, Suppliers, Rival firms, Employment, Licences, Consultants, Formal strategic alliances/joint ventures, Public sector organisations, Private sector organisations, such as private training or research providers and consultants, Literature/patents, Conferences, trade fairs, exhibitions, Professional and trade associations, Universities or other higher education institutes, Contract research, Research cooperation, Business networks, Informal contacts. Each type of knowledge source was further subdivided into Regional, National, and International. Tables 7.3, 7.4 and 7.5 show Spearman correlations between KIBS sub-sectors and the various external sources of knowledge within the region (Table 7.3), UK-wide (Table 7.4) and internationally (Table 7.5). The information from Tables 7.3, 7.4 and 7.5 is analysed and presented in section 7.4- Main Findings.

Table 7.3 Correlation between KIBS sub-sectors and regional sources of knowledge

		Customers	Suppliers	Rival firms	Employment	Licences	Consultants	Formal strategic alliances/joint ventures	Public sector organisations	Private training or research providers and consultants	Literature/patents	Conferences, trade fairs, exhibitions	Professional and trade associations	Universities or other higher education institutes	Contract research	Research cooperation	Business networks	Informal contacts
Computer and related	Correlation Coefficient	.006	-.051	-.025	-.034	.009	**-.133***	-.031	-.100	-.107	-.077	-.033	**-.150****	-.023	-.026	-.001	.059	.065
	Sig. (2-tailed)	.909	.359	.654	.550	.879	.016	.576	.071	.053	.166	.549	.007	.676	.636	.992	.288	.235
	N	329	329	330	312	321	328	329	329	328	328	330	329	327	325	325	330	330
Engineering and Architecture	Correlation Coefficient	-.088	.025	-.069	-.005	.005	**.150****	-.048	.000	.070	.047	-.065	.016	**-.166****	-.030	.006	**-.201****	-.041
	Sig. (2-tailed)	.109	.653	.214	.930	.935	.007	.388	.993	.208	.395	.241	.773	.003	.593	.920	.000	.460
	N	329	329	330	312	321	328	329	329	328	328	330	329	327	325	325	330	330
Management Consultants	Correlation Coefficient	-.009	-.093	.053	.006	-.070	.006	.089	**.109***	.014	.079	.083	**.136***	**.112***	.003	-.021	**.119***	.026
	Sig. (2-tailed)	.871	.094	.340	.911	.213	.921	.108	.048	.797	.155	.131	.013	.043	.952	.709	.030	.637
	N	329	329	330	312	321	328	329	329	328	328	330	329	327	325	325	330	330
Advertising and Publishing	Correlation Coefficient	**.159****	.076	.056	.017	.026	-.005	-.038	-.039	.007	**-.114***	.045	-.024	-.019	.007	-.016	.056	**-.114***
	Sig. (2-tailed)	.004	.172	.311	.764	.639	.924	.492	.482	.898	.039	.417	.669	.726	.902	.781	.310	.039
	N	329	329	330	312	321	328	329	329	328	328	330	329	327	325	325	330	330
R&D	Correlation Coefficient	-.048	**.116***	-.024	-.019	.000	-.008	-.020	.061	.000	-.005	**-.117***	-.003	**.124***	.011	.089	.016	-.034
	Sig. (2-tailed)	.386	.035	.661	.744	.994	.889	.713	.267	.994	.934	.034	.962	.025	.837	.111	.779	.535
	N	329	329	330	312	321	328	329	329	328	328	330	329	327	325	325	330	330

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 7.4 Correlation between KIBS sub-sectors and UK sources of knowledge

		Customers	Suppliers	Rival firms	Employment	Licences	Consultants	Formal strategic alliances/joint ventures	Public sector organisations	Private training or research providers and consultants	Literature/patents	Conferences, trade fairs, exhibitions	Professional and trade associations	Universities or other higher education institutes	Contract research	Research cooperation	Business networks	Informal contacts
Computer and related	Correlation Coefficient	-.013	-.017	-.086	-.014	.022	-.085	-.058	**-.134***	**-.127***	**-.164****	-.066	**-.124***	**-.111***	-.077	-.023	-.013	.002
	Sig. (2-tailed)	.810	.761	.119	.803	.696	.123	.295	.015	.021	.003	.231	.024	.043	.163	.679	.820	.968
	N	327	329	330	317	323	328	329	329	329	330	330	330	329	329	329	330	330
Engineering and Architecture	Correlation Coefficient	**-.111***	-.053	**-.123***	-.032	-.064	-.095	**-.148****	-.061	.003	-.042	-.100	-.053	**-.127***	-.073	-.079	**-.195****	**-.122***
	Sig. (2-tailed)	.045	.335	.025	.565	.254	.086	.007	.269	.951	.444	.070	.339	.021	.189	.151	.000	.026
	N	327	329	330	317	323	328	329	329	329	330	330	330	329	329	329	330	330
Management Consultants	Correlation Coefficient	.021	-.046	.101	-.003	-.024	**.171****	**.156****	**.141***	.028	**.186****	**.117***	**.159****	.082	.052	-.015	**.132***	.100
	Sig. (2-tailed)	.700	.405	.066	.962	.665	.002	.005	.011	.611	.001	.034	.004	.137	.343	.780	.016	.070
	N	327	329	330	317	323	328	329	329	329	330	330	330	329	329	329	330	330
Advertising and Publishing	Correlation Coefficient	.064	.006	.081	-.008	.019	-.071	-.042	-.030	.031	**-.121***	.028	-.056	.068	.012	-.045	.035	-.075
	Sig. (2-tailed)	.247	.909	.141	.887	.738	.202	.453	.587	.578	.028	.615	.314	.219	.823	.420	.529	.174
	N	327	329	330	317	323	328	329	329	329	330	330	330	329	329	329	330	330
R&D	Correlation Coefficient	**.137***	**.255****	.092	.029	.037	.062	.107	**.145****	**.120***	**.152****	.073	**.139***	**.207****	.101	**.244****	**.160****	.081
	Sig. (2-tailed)	.013	.000	.095	.607	.509	.266	.052	.008	.030	.006	.183	.012	.000	.066	.000	.004	.143
	N	327	329	330	317	323	328	329	329	329	330	330	330	329	329	329	330	330

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table7.5 Correlation between KIBS sub-sectors and international sources of knowledge

		Customers	Suppliers	Rival firms	Employment	Licences	Consultants	Formal strategic alliances/joint ventures	Public sector organisations	Private training or research providers and consultants	Literature/patents	Conferences, trade fairs, exhibitions	Professional and trade associations	Universities or other higher education institutes	Contract research	Research cooperation	Business networks	Informal contacts
Computer and related	Correlation Coefficient	-.045	.066	-.051	-.033	-.052	-.054	-.038	-.070	-.087	-.093	-.009	-.090	-.077	-.053	.027	-.056	-.031
	Sig. (2-tailed)	.417	.232	.358	.549	.343	.327	.492	.202	.114	.090	.870	.100	.161	.333	.619	.312	.577
	N	329	332	332	328	329	331	330	330	329	331	332	332	330	331	330	332	331
Engineering and Architecture	Correlation Coefficient	-.090	-.065	-.018	.059	-.050	-.071	-.062	-.061	-.090	-.073	-.090	-.051	-.051	-.049	-.061	-.093	-.083
	Sig. (2-tailed)	.105	.239	.740	.289	.368	.199	.261	.270	.104	.186	.103	.354	.359	.372	.270	.091	.133
	N	329	332	332	328	329	331	330	330	329	331	332	332	330	331	330	332	331
Management Consultants	Correlation Coefficient	.035	-.016	.028	-.003	.081	.092	.064	.054	.049	.092	.083	**.122***	.052	.082	-.044	.100	.060
	Sig. (2-tailed)	.527	.778	.609	.964	.141	.095	.248	.332	.375	.093	.133	.026	.342	.136	.422	.069	.280
	N	329	332	332	328	329	331	330	330	329	331	332	332	330	331	330	332	331
Advertising and Publishing	Correlation Coefficient	.105	-.009	.028	-.050	-.056	-.013	-.032	-.003	.069	.065	-.060	-.039	-.023	.006	-.002	.021	-.043
	Sig. (2-tailed)	.056	.871	.610	.364	.315	.816	.568	.963	.213	.236	.272	.484	.677	.911	.968	.709	.439
	N	329	332	332	328	329	331	330	330	329	331	332	332	330	331	330	332	331
R&D	Correlation Coefficient	**.109***	.055	.040	-.028	.073	.050	**.117***	.061	**.197****	.084	**.133***	.092	**.211****	-.031	**.159****	**.123***	**.227****
	Sig. (2-tailed)	.048	.318	.463	.611	.186	.368	.033	.273	.000	.129	.016	.096	.000	.574	.004	.025	.000
	N	329	332	332	328	329	331	330	330	329	331	332	332	330	331	330	332	331

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

7.3.2 Analysis Technique

The next section applies knowledge bases taxonomy as presented in Table 7.1 to KIBS sub-sectors. In relation to the geography of analytic and synthetic knowledge, it is expected that the ratio of synthetic international knowledge to the synthetic regional knowledge will be smaller compared to the ratio of analytic international knowledge to the analytic regional knowledge. This is because synthetic knowledge is perceived as more tacit compared to the analytic knowledge and as a result synthetic knowledge is expected to be more local. In other words, geographic proximity will be more important to those firms with a more tacit (synthetic) knowledge base as opposed to those with a more explicit (analytic) knowledge base (Gertler, 2003).

The results in Table 7.6 and 7.7 confirm this proposition and show that the difference between the two ratios is indeed statistically significant and that in both tables the ratio of synthetic international knowledge to synthetic regional knowledge (Table 7.6) and the ratio of synthetic international knowledge to synthetic regional and national knowledge (Table 7.7) are both smaller. Thus, the results in Tables 7.6 and 7.7 indicate that synthetic knowledge is more strongly associated with "local" sources compared to analytic knowledge.

Table 7.6 The geography of synthetic and analytic knowledge (ratio of international knowledge to regional knowledge)

	t	df	Sig. (2-tailed)	Mean Difference
Ratio of synthetic international/ to synthetic regional knowledge	12.051	328	.000	.60358
Ratio of analytic international/ to analytic regional knowledge	29.465	327	.000	.69441

Table 7.7 The geography of synthetic and analytic knowledge (ratio of international knowledge to regional and national knowledge)

	t	df	Sig. (2-tailed)	Mean Difference
Ratio of synthetic international/ to synthetic national and regional knowledge	14.804	329	.000	.29429
Ratio of analytic international/ to analytic national and regional knowledge	35.280	328	.000	.35646

The analysis in Tables 7.8 and 7.9 aims to establish to what extent are KIBS sub-sectors differentiated according to their proposed knowledge bases. The results of a linear regression in Table 7.8 show that after controlling for firms size, vintage, region and location in cities, Management consultants and Computer and related KIBS are significantly different to the control KIBS sub-sector (Engineers and Architects). The regression results in Table 7.8 show that Management consultants and Computer and related KIBS are positively associated with the synthetic knowledge base.

Table 7.8 Association with synthetic knowledge base: Results from the linear regression

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.133	.110		10.305	.000
Log firm size	.042	.052	.049	.811	.418
Log firm vintage	-.093	.081	-.070	-1.143	.254
Region (North East)	-.058	.049	-.065	-1.167	.244
Location (city vs. rest)	-.019	.055	-.019	-.349	.727
Management consultants	**.150**	**.070**	**.159**	**2.141**	**.033**
Computer and related	**.147**	**.071**	**.154**	**2.067**	**.040**
R&D and Technical testing	-.074	.109	-.042	-.682	.496
Advertising and publishing	.122	.102	.075	1.196	.233

Notes: Engineers and Architects as a control group
Dependent variable-Ratio of synthetic to analytic knowledge

In order to test the robustness of the above result one way-ANOVA test was performed on KIBS sub-sectors. The results in Table 7.9 show that Engineers and Architects and R&D and Technical testing KIBS are indeed significantly different to the Computer and related KIBS. These two KIBS sub-groups (Engineers and Architects and R&D and Technical testing) are significantly more associated with the analytic knowledge base compared to other KIBS sub-sectors.

Table 7.9 Synthetic knowledge vs. analytic knowledge: differences between KIBS sub-sectors (One way-ANOVA)

(I) KIBS sub-sector	I	J	Mean Difference (I-J)	Std. Error	Sig.
LSD (Least significant difference)	Computer and related	Management consultants and Market research	.00595	.05933	.920
		Engineers and Architects	**.19101***	**.06799**	**.005**
		R&D and Technical testing	**.24018***	**.10241**	**.020**
		Advertisers and Publishers	.02952	.09425	.754

Note: Dependent variable-Ratio of synthetic to analytic knowledge

Finally, the analysis in Table 7.10 aims to establish to what extent are those KIBS sub-sectors that are associated with the analytic knowledge base also associated with sourcing knowledge internationally. The results in Table 7.10 show that compared to Computer and related KIBS, only R&D and Technical testing KIBS are significantly more associated with the international knowledge sourcing. These results indicate that some analytic KIBS (R&D and Technical testing KIBS in particular) are more “non-local” than other analytic KIBS (Engineers and Architects for example). This result suggests that the common assumption which separates analytic knowledge (assumed to be non-local) and symbolic knowledge (perceived as relatively local), may be too simplistic.

Table 7.10 International knowledge vs. regional knowledge; differences between KIBS sub-sectors (one way-ANOVA)

(I) KIBS sub-sector	I	J	Mean Difference (I-J)	Std. Error	Sig.
LSD	Computer and related	Management consultants and Market research	.00730	.07539	.923
		Engineers and Architects	.04952	.08635	.567
		R&D and Technical testing	**-.23903**	**.13188**	**.071**
		Advertisers and Publishers	.08342	.12087	.491

Note: Dependent variable-Ratio of international to regional knowledge

7.4 Main Findings

Computer and related services

Computer and related services include software design and analysis, computer programming, computer installation and maintenance consulting, computer rentals, database management, data processing services etc. (Warf, 2010). Software ranges from a lucrative customised programmes to pre-packaged standardised applications and the mode of delivery varies from direct personal contact to downloaded programmes via the internet. Thus, it is acknowledged that even within this particular sub-group some important differences between firms exist in relation to the degree of standardisation as well as knowledge intensity of their service provision.

Spearman correlation results are presented in Tables 7.2, 7.3, 7.4 and 7.5. Computer and related firms are strong product/service innovators (Table 7.2). They are less likely to draw external knowledge from Consultants and Professional trade organisations within the region (Table 7.3) and they are also less likely to draw external knowledge from the Public sector, Private training providers, Literature and patents and Professional trade organisations within the UK (Table 7.4).

In general, Computer and related firms are product/service innovators who largely rely on their own/internal software/computing skills and knowledge and engage in informal networking mostly within the region but also within the UK (possibly drawing from previous employment experience and informal connections widely in the UK). The finding that Computer and related KIBS engage in product/service innovation is consistent with Pina and Tether (2016). Computer and related are significantly less likely to draw from formalised or commercial/traded sources of knowledge and are not restricted to cities for their location, they tend to be more "footloose". They engage somewhat in R&D but this is not a defining feature. Computer and related are comparably younger companies, involved less in process innovation and marketing innovation (new markets). They are less likely to use patents and literature as a source of knowledge. Qualitative answers in the survey show that they also frequently cite "internet" as an important source of knowledge.

The analysis in Tables 7.8, 7.9 and 7.10 shows that Computer and related KIBS are significantly different to Engineers and Architects and R&D and Technical testing KIBS with regards to their respective knowledge bases. These two KIBS sub-groups are associated with the analytic knowledge base, whereas Computer and related are associated with the synthetic knowledge base. Hence, in answer to research question 8, it can be concluded that findings show that Computer and related KIBS do not resemble analytic knowledge base.

Engineering and Architecture

Engineering and Architecture comprise of services involved in the production of a variety of design, architecture and planning functions closely linked to the construction of complex, large-scale commercial and residential buildings, transportation systems and other infrastructural projects (e.g. bridges, hydro electronic dams) (Warf, 2010). Architecture, in particular, refers to the design and planning but not construction of the built environment of the residential, public and commercial buildings and infrastructure (Warf, 2010). It has been argued that in the UK, architecture is rooted in art and design with a strong orientation in the creative arts

(Tether et al., 2012). In contrast, engineering has strong grounding in sciences and maths. The growth of increasingly global cities around the world has fuelled the growth of acclaimed UK architects and their firms with a worldwide reach. However, these characteristics are mostly associated with the internationally acclaimed UK architects and their firms which tend to reside in London and the South East where they establish international reputation. In contrast, architects in more peripheral regions rely mostly on regional and UK contracts, predominantly from government agencies and consumers (see Chapter 5).

Spearman correlation results (Tables 7.2, 7.3, 7.4 and 7.5) show that Engineers and Architects are less likely to invest in R&D (Table 7.2), they are also less likely to draw external knowledge from Regional Universities and Business networks (Table 7.3). Table 7.3 also shows that they are more likely to draw external knowledge from Regional Consultants. Table 7.4 indicates that they are less likely to draw external knowledge from Customers, Rival firms, Formal strategic alliances/joint ventures, Universities, Business networks and Informal contacts.

In general, Engineers and Architects tend to be process innovators, more likely to depend on cities for their location but not significantly, not likely to invest in R&D, significantly older companies with less employees. They rely on internal engineering knowledge, drawing from local public knowledge infrastructure. They are significantly unlikely to draw from local informal networks but from more traded formalised sources as well as patents and literature but not a defining feature.

The nature of Engineering and Architectural services is almost always highly idiosyncratic as their consultative services are personally provided and underwritten. They do not produce a tangible commodity hence key attributes are data exchange, documentation and personal mobility. Engineers and Architects have increasingly sought clients on a global basis. Government restrictions in form of regulations often play role in spatial pattern of trade and joint ventures with local suppliers are often used to gain foothold in foreign markets. However, the survey findings show that Engineering and Architecture firms are unlikely to source knowledge from formal strategic alliances and joint ventures.

The analysis in Tables 7.8, 7.9 and 7.10 shows that Engineering and Architecture KIBS are significantly different to Management consultants and Computer and related KIBS with regards to their respective knowledge bases. These two KIBS sub-groups are associated with the symbolic knowledge base, whereas Engineers and Architects are relatively more associated with the analytic knowledge base. Thus, in answer to research sub-question 9, it can be concluded that Engineering and Architecture do not resemble symbolic knowledge base.

Management Consultants

Management consultants provide all forms of advice to corporations which are designed to improve their performance, enhance efficiencies, utilise “best practices”, minimise problems such as with human resources and maximise their image with consumers (Warf, 2010, 28). Spearman correlation results (Tables 7.2, 7.3, 7.4 and 7.5) indicate that Management consultants are strong marketing innovators (Table 7.2). They are more likely to draw external knowledge from the Public sector, Professional and trade organisations, Universities and Business networks within their region (Table 7.3). They are also more likely to draw external knowledge from Consultants, Formal strategic alliances/joint ventures, Public sector, Literature and patents, Conferences/trade fares and exhibitions, Professional and trade organisations and Business networks within the UK (Table 7.4) as well as Professional and trade organisations abroad (Table 7.5).

Management consultants rely heavily on personal contacts, trust and brand name reputation but also on more formalised sources such as trade associations and business networks. They are not likely to invest in R&D. Generally, Management consultants tend to underreport product/service and process innovation but are significantly more likely to have introduced marketing innovation. They rely on internal financial and managerial knowledge. Management consultants trade UK widely and mainly with UK services (see chapter 5). This is in line with Jones (2003) who reports that management consulting is critical in local and national context due to considerable uncertainty and cultural and linguistic differences.

UK has a long tradition in exporting managerial consulting services but it seems that this generally applies to London and the South East based consultancy firms. Consultants in de-industrialised regions seem to rely mostly on local and national contracts. The analysis in Tables 7.8, 7.9 and 7.10 shows that Management consultants and Computer and related KIBS are significantly different to Engineers and Architects and R&D and Technical testing KIBS with regards to their respective knowledge bases. These two KIBS sub-groups are associated with the analytic knowledge base, whereas Management consultants and Computer and related are associated with the synthetic knowledge base. Thus, in answer to research sub-question 9, it can be concluded that the results do indicate that Management consultants rely predominantly on synthetic knowledge.

Advertisers and Publishers

Spearman correlation results (Tables 7.2, 7.3, 7.4 and 7.5) indicate that Advertisers and Publishers are likely to be larger firms (Table 7.2). They are more likely to draw external knowledge from Regional Customers but less likely to draw from Literature/patents and Informal contacts within the region (Table 7.3). They are also less likely to draw external knowledge from Literature/patents from the UK (Table 7.4). The analysis in Tables 7.8, 7.9 and 7.10 shows that Advertisers and Publishers are not significantly different to other KIBS sub-sectors with regards to their respective knowledge bases. They share similarities with both synthetic and analytic KIBS sub-groups. Thus, in answer to research sub-question 10, it can be concluded that Advertisers and Publishers are actually associated with both analytic and synthetic knowledge base. It should be noted that due to the data limitations it is not possible to test to what extent do Advertisers and Publishers depend on the symbolic knowledge base.

R&D and Technical testing and analysis

Spearman correlation results (Tables 7.2, 7.3, 7.4 and 7.5) indicate that R&D firms are defined by their strong investment in R&D (Table 7.2).

Compared to other KIBS sub-groups they engage in sourcing external knowledge more extensively. They are more likely to draw external knowledge from Suppliers and Universities within their region but less likely to draw knowledge from Conferences/trade fairs and exhibitions (Table 7.3). They are also more likely to draw knowledge from Customers, Suppliers, Public sector, Private training providers, Literature and patents, Professional and trade associations, Research cooperation, Business networks and Universities within the UK (Table 7.4). R&D and Technical testing firms are also more likely to draw external knowledge from Customers, Formal strategic alliances/joint ventures, Conferences, trade fairs and exhibitions, Research cooperation, Business networks and Informal contacts abroad (Table 7.5).

The analysis in Tables 7.8, 7.9 and 7.10 shows that R&D and Technical testing KIBS and Engineers and Architects are significantly different to Computer and related KIBS with regards to their respective knowledge bases. These two KIBS sub-groups are associated with the analytic knowledge base, whereas Computer and related are associated with the synthetic knowledge base. In answer to research sub-question 8, it can be concluded that R&D and Technical testing firms do indeed resemble characteristics of predominantly analytic knowledge base. It should be noted that they are more internationally oriented compared to all other KIBS sub-groups. This finding provides the support for contention that analytic knowledge indeed travels further distances.

7.5 Conclusion

KIBS have been identified as drivers of innovation in their own right but also as facilitators of innovation in their clients. So far, the literature has emphasised that KIBS are distinct from other sectors, especially manufacturing. Nevertheless, only limited research has sought to examine variety within KIBS. In this chapter analysis was conducted by applying knowledge base conceptualisation to different KIBS sub-sectors. The results indicate that professional and technological KIBS escape easy classification. The core competence of combining different forms of knowledge to produce tradable output is common to all KIBS but the differences across this sector are not negligible. Along these lines, it is suggested that a great deal of diversity will be observed in the prevailing knowledge bases. Hence, important sectoral differences but also some similarities emerge from this analysis.

Computer and related KIBS tend to rely on internal software knowledge but source external knowledge locally (within region) and mainly by informal /non-contractual means (business networks and personal contacts). Engineers and Architects rely on internal engineering knowledge, source knowledge locally but mostly by formal ways such as regional consultants and public sector organisations. They are relatively more associated with the analytic knowledge base which is somewhat contrary to predictions. Management consultants draw from internal managerial and financial knowledge, source knowledge both informally through local networks but also via professional and trade associations and business networks in the UK. They are associated with synthetic knowledge base. Computer and related firms are strong product/services innovators whereas Management consultants tend to be marketing innovators. Advertisers and Publishers are associated with both analytic and synthetic knowledge bases (contrary to predictions), whereas R&D and Technical testing and analysis are differentiated by the analytic knowledge base.

Some theoretical assumptions about the nature and geography of knowledge divided into analytic and synthetic have been tested on a KIBS sample. Computer and related firms were originally associated with analytic knowledge, whereas and Engineering and Architecture firms are assumed to be more synthetic hence spatially co-located with external partners and were not expected to draw from nationally located sources of knowledge. This holds true to a certain extent as both Computer and related as well as Engineering and Architecture firms indeed rely predominantly on local sources of knowledge. Computer and related firms draw external knowledge from both informal and business networks whereas Engineers and Architects rely extensively on formalised networks and significantly less on local informal networks. Moreover, it has been shown that Engineers and Architects draw knowledge from public sources similarly to firms who belong to analytic knowledge base group.

Management consultants show characteristics of synthetic industries as they draw mostly from local informal networks including trade fairs and exhibitions. However, they also draw from national trade associations and business networks as well as universities. R&D and Technical testing are perhaps most clearly associated with the analytic base but internationally these firms also source knowledge from sources associated with the synthetic knowledge base. Further, Advertisers and Publishers draw from synthetic and analytic knowledge base. It should be noted that these firms are usually associated with the symbolic knowledge base but the nature of the data set does not allow for testing of this proposition.

It has been suggested that classification of KIBS sub-sectors according to their primary knowledge base complements the Standard Industrial Classification (Pina and Tether, 2016). The results show that classification of KIBS sub-sectors into analytic, symbolic and synthetic knowledge bases is useful but also that some KIBS sub-sectors behave contrary to the assumptions postulated in differentiated knowledge bases literature. Moreover, most KIBS sub-sectors can be associated with more than one knowledge base. As important sectoral differences between KIBS sub-sectors emerge from this study it is confirmed that KIBS do not represent a homogenous group. Exploratory nature of this study calls for more research to test the results in different regional settings and in different national contexts making the distinction between larger KIBS and the smaller ones.

CHAPTER 8: TOWARDS A BETTER UNDERSTANDING OF THE ROLE OF KIBS SMEs IN REGIONAL DEVELOPMENT

8.1 Introduction

The purpose of this chapter is to revisit the main research question and explain what has been learned empirically and conceptually as well as to highlight some of the limitations of this study and provide suggestions for further research. The current chapter is also concerned with the wider significance of the research findings and implications for policy as a by-product of what has been learned as a result of this research.

The decline of manufacturing and rise of services, which started in 1970s, induced significant structural changes in the UK economy (Marshall, 1998). These structural changes are also integral to the development of existing spatial inequalities and the growth of new patterns of unequal development (Marshall, 1988, 31). It is clear that post-industrial services concentration and in particular growth of international finance has benefited the South East of England and that de-industrialisation of the North East and the West Midlands brought about limited prospects for development aided by KIBS. However, since the latter part of the 1970s some optimism came about as a result of the newly perceived potential of service industries to stimulate economic development in lagging or peripheral regions (Wernerheim and Sharpe, 2003).

This is because KIBS became recognised as important contributors to the economic base of their regions (Coffey and McRae, 1989). According to the economic base theory exportable sectors create injections to the local economy, which through the multiplier mechanism and the circular flow of income stimulate local economic growth (Armstrong and Taylor, 2002; Coffey and McRae, 1989). It has been argued that advances in information technology have changed the way services are produced and delivered having enabled interregional and international trade in services hence, giving KIBS more prominent role in the economic base of regions (Beyers and Alvine, 1985; Wood, 1991).

At the root of this optimism is the perception that KIBS may be footloose, or in other words free from location constraints (Coffey and McRae, 1989; Wernerheim and Sharpe, 2003). It is believed that due to their tradability KIBS do not face the same constraint of physical proximity to their markets. Therefore peripheral and de-industrialised regions alike should be able to develop and attract export-oriented KIBS (Coffey and McRae, 1989). Moreover, through their role in innovation and technological change, KIBS may contribute to facilitating overall economic change and adaptation towards knowledge-based economy as well as enhance the competitiveness of their clients.

The UK data shows that KIBS are not only exportable but also highly responsive to external demand. For example, in 2007 manufactured goods represented 44% of UK exports, just five points higher than the share of services (39%) (NESTA, 2010). The increase in the contribution of services has been driven significantly by business and financial services. Their share of exports has gone up from 10% to 25% in the same period (an additional 7.5 points each) (NESTA, 2010). This large share highlights the comparative advantage that the UK has developed in this sector. The UK and the US are the largest exporters of both business and financial services in the world, with the UK ahead of the US in some years (e.g. 2007) (NESTA, 2010).

And while the UK KIBS exporting figures are indeed impressive, it is pertinent to ask whether KIBS can be an engine of economic development in de-industrialised regions? The evidence from many countries shows that at the spatial level, the most strategic business services are concentrated in large metropolitan areas. In the UK this concentration is largely limited to London and the South East to the detriment of other regions. In light of this trend it is important to establish whether policies targeted at supporting existing and new KIBS in de-industrialised regions are likely to be an effective tool for regional development. Motivated by this question, this thesis seeks to evaluate the role of KIBS in de-industrialised regions and to provide some insights into whether economic development in such regions can be promoted by supporting existing and new KIBS.

It should be noted that this thesis deals with just two specific topics, namely regional development and KIBS innovation, whereas issues of international trade, macro scale structural change, financing of KIBS innovation and implications for supply and demand for labour have not been investigated in this research. And while observations are related to the UK context they have a broader applicability to other de-industrialised regions.

The chapter is structured as follows: section 8.2 provides some insights into academic thinking relating the role of services and KIBS in regional development. Section 8.3 provides summary of main findings. Section 8.4 highlights the main contribution of this research to the literature whereas section 8.5 provides policy implications and suggestions for further research. Section 8.6 points to some limitations of this research and section 8.7 is a concluding section.

8.2 The role of KIBS in Regional Development

While persistent classificatory and data problems continue to pose challenges in relation to measuring and analysing KIBS, it is clear that the UK has experienced a long-term growth in KIBS. Therefore, it is essential that further work on spatial differentiation concentrates on establishing KIBS' role in promoting structural changes in the economy. This is because such changes have profound implications for spatial inequalities and the important question is: What role can KIBS play in the process of reducing spatial inequalities between the UK regions?

Unfortunately there is no single established view regarding KIBS' role in developed economies. Moreover, while the UK has experienced "de-industrialisation" the term itself lacks precise definition (Marshall, 1988). At its simplest, a "post-industrial" economy is one in which majority of its workforce is engaged in service work. However, in Bell's (1973) view this also implies associated social change and increasing prominence of professional and technical elites in the society. Nevertheless, it is not at all certain that all KIBS jobs are professional and elite. In contrast to this sociological and occupational emphasis other "de-industrial" interpretations emphasise the economic and industrial aspects of structural change in the economy (Marshall, 1988).

Hence, at its simplest, de-industrialisation may mean an absolute reduction in manufacturing employment or a fall in its share in total employment but frequently it has been used to signify manufacturing decline (Marshall, 1988). One common feature of the UK economy and its reoccurring balance of payments position is a competitive weakness of the manufacturing sector compared to KIBS. This is reflected in a failure of the UK manufacturing sector to maintain a surplus in export over imports. On the contrary, KIBS continue to show a surplus of exports over imports (NESTA, 2010). This is in contrast with a view of services as less competitive and less productive than manufacturing. Hence, the proposition that the growth of services occurs as a result of their slower productivity growth clearly does not apply to KIBS.

What has been an impact of the decline in manufacturing employment on KIBS in de-industrialised regions? A de-industrialisation view is not, however, the complete picture as KIBS are not exclusively dependent on manufacturing demand. In fact, as shown in Chapter 5 the higher proportion of KIBS output goes to other services (including the public sector) compared to manufacturing. In light of this evidence it may be argued that it is KIBS (as services which serve as inputs into the production of other services) that have the greatest potential to stimulate growth in any region. There are several reasons why this may be the case. First, as shown in Appendix III KIBS are a growing sector in the UK. Over the period 2000-2008, employment in KIBS experienced a growth rate of 26%. KIBS may as a result provide employment and replacement for lost manufacturing jobs.

Second, KIBS can constitute an important element of the economic base of a region. As discussed in Chapter 5, it is export-oriented activities which serve as an engine of growth. KIBS firms create injections into the regional economy which, through multiplier effect and circular flow, stimulate local economic growth. Due to their tradability KIBS do not face the same constraints of physical proximity to their markets. In theory, de-industrialised regions should be able to develop export-oriented KIBS. Third, and perhaps most importantly as discussed in Chapter 6, through their role as innovators, KIBS may contribute to enhancing spatial variation in the economic development process and technological change. They play a strategic role within the production system based on the contribution they make to their customers. Their direct contribution may be difficult to establish precisely but it can be assumed that, through their own innovativeness, KIBS enhance the competitiveness of other sectors as initiators and co-producers of innovation with their clients.

Related to this is the fourth role KIBS play in the overall adjustment of skills and the underlying knowledge bases of their respective regions. In this respect, as discussed in Chapter 7, different KIBS sub-sectors are characterised by differentiated knowledge bases. Hence, all of the above four aspects are important for our understanding of KIBS' contribution to the process of regional development. Next section summarizes the main findings of this research by highlighting answers to the research questions and research sub-questions.

8.3 Summary of Main Findings

As stated above the main goal of this research was to ascertain: **What is the role of KIBS SMEs in promoting economic development in de-industrialised regions?** In order to address the above main further research questions were proposed:

- To what extent do KIBS depend on the industrial structure of their regions and to what extent are they tradable across space?

- What are the determinants of KIBS innovativeness?

- How do different KIBS sub-sectors differ in their role as facilitators of knowledge across space?

Analysis in Appendix III shows that prospects for developing KIBS base in de-industrialised regions seem encouraging at first sight, given a relatively large percentage increases in both numbers of KIBS establishments as well as employment in KIBS. Positive percentage increases in KIBS employment in these regions, however, should be interpreted with caution given their relatively low base. These KIBS are also regionally important, not so much because of their global reach but because they provide important support functions to other local sectors which is one of the general characteristics of all KIBS regardless of where they may be located.

KIBS Structural Role

Related to the location and growth of KIBS in de-industrialised regions is research question A which forms basis of the empirical analysis in Chapter 5. This chapter is concerned with the structural role which KIBS SMEs play in the two case study regions. KIBS' contribution was assessed in relation to their exporting ability, within the UK as well as abroad, but also the extent of their dependence on the industrial base of their regions. In Chapter 5 KIBS' activities were also assessed in the context of the structural role they play in supporting other sectors while taking into account possible differences between KIBS sub-sectors, location, vintage and their size. Further, sub-questions were developed and answered by analysing the unique empirical evidence from an original survey of KIBS SMEs. The rest of this section revisits proposed sub-questions 1-4 and discusses the main findings.

1: Do any particular KIBS sub-sectors have a higher propensity to export outside their regions than others?

The findings show that Advertising and Publishing KIBS, Engineers, Technical testing and analysis and R&D have the highest propensity to export outside the region. Architects and Urban planners have the lowest propensity to do so. When exports abroad are considered, no statistically significant differences are found between the KIBS sub-sectors but it is notable that 25% of all KIBS do export abroad. In terms of revenue generated, the most internationally successful KIBS are Engineering firms followed by Business consultants, whereas Architects and Urban planners are relatively more locally orientated, gaining the greatest proportion of their sales from within the region.

2: Do KIBS which are (i) located in cities; (ii) larger KIBS; and (iii) more mature KIBS exhibit higher propensity to export outside their region?

Even though there are no statistically significant differences between sub-sectors, the results show that a slightly higher percentage of KIBS located in towns, villages and countryside exported abroad and had sales outside the region compared to those located in cities. In answer to the second part of sub-question 2, it should be noted that there are statistically significant differences between KIBS of different sizes in terms of exports outside their respective regions. Micro KIBS (1-5 employees) show the smallest propensity to sell outside their region. When exports abroad are analysed there are also statistically significant differences between the KIBS of different sizes. The highest proportion of exporters again comes from the medium group (26+ employees), followed by the small group (6-25 employees) and micro group (1-5 employees). In answer to the third part of sub-question 2, results show no statistical differences between sub-sectors. However, it should be noted that mature (11 years+) and medium firms (6-10 years) are more likely to report sales outside the region as well as sales abroad compared to young KIBS. However, 75% of young firms (up to 5 years) do report sales outside their region.

3: Which sectors and in which locations provide the most important customer base for the North East and the West Midlands KIBS?

The analysis in Chapter 5 shows that the main market for the North East and the West Midlands KIBS SMEs is mostly other services. However, manufacturing industry is also important source of demand for some KIBS (Engineering in particular). When the results are compared across the KIBS sub-sectors it is evident that Computer and related KIBS earn significant revenue from the UK, regional and foreign households.

KIBS in the R&D category depend largely on government and public sector contracts as do Advertisers, Technical testing and Architects. It is Engineering KIBS that depend mostly on revenue from the manufacturing sector located in their region, across the UK and abroad. Business and management consultants have the strongest links with other services whereas Engineers have the weakest links to services compared to other KIBS. Indeed ANOVA test shows significant differences between KIBS sub-sector groups for all of the demand source categories, namely manufacturing, services, consumers, universities and government contracts, on the regional, UK and international level.

4: What are the most important factors that explain KIBS location?

The most important location factor for all KIBS sub-sectors is proximity to owner's home. The second most important factor is quality of life and the third is low cost of premises. A general picture which emerges is that these are firms which are indigenous to the area where they locate. It should also be noted that proximity to customers does not play important role in location decisions for most KIBS but it is slightly more important for Architects and Urban planners, Advertisers and Publishers and Computer and related KIBS. Proximity to suppliers and to firms in related industries do not play a decisive role for any of the KIBS sub-sectors. Hence, it seems that localisation economies do not provide satisfactory conceptual basis for explaining KIBS SMEs location patterns. Proximity to other firms in related industry is only slightly more important for Architects and Urban planners.

In addition, most KIBS state “good quality of life” and “the availability of local amenities” as some of the most important factors. It should be noted that good international connectivity is particularly important for KIBS located in the West Midlands. This result is statistically significant. Availability of skilled staff and informal networks are somewhat important but not decisively so.

It has been noted before that there has been a dearth of research on the structure of KIBS activities (Wood, 2012) and in particular the role of intermediate demand in the localisation of KIBS (Meliciani and Savona, 2014). Hence, the analysis in Chapter 5 aims to bridge this gap in the literature and to provide up to date evidence related to the geography and the nature of demand for KIBS SMEs in de-industrialised regions. The results from the West Midlands and North East survey indicate that although KIBS play an important role in local economic base of de-industrialised regions, they are not comparable to the elite, tradable KIBS in global cities such as London. KIBS in de-industrialised regions provide mostly indirect support to their regional clients but many are active nationally. It seems that a number of these KIBS SMEs are associated with the underlying industrial specialisation and declining manufacturing base.

This implies that further decline of manufacturing industry will have a negative effect on some KIBS and that in de-industrialised regions KIBS may not provide a solution for de-industrialisation and downsizing of the public sector. The danger is that many KIBS in de-industrialised regions may just become a part of a value chain that dissolves locally. For policy makers who seek to address regional disparities in the UK these findings create a challenging problem, suggesting that recession (accompanied by an ongoing de-industrialisation and future public sector downsizing) is likely to worsen, rather than reduce regional disparities. This is because the prospects for KIBS led growth may be hampered by declining demand for their services.

These findings are in line with some previous studies that investigate KIBS' structural role. These studies showed that many KIBS offer routine, professional, financial and business expertise based on close familiarity and repeated business from clients located in their own or nearby regions (see for example Keeble et al., 1991; Wood et al., 1993). A minority are also active in national and international markets often reflecting long established regional expertise, e.g. in engineering, design and logistics and more recently in IT and software often stimulated by the competitiveness of their clients (O'Farrell et al., 1998).

A number of more recent empirical studies assess KIBS relationships with manufacturing clients and report that their location near industrial belts creates specialisation in KIBS related to the, for example, oil extraction industry in Alberta, Canada (see for example Shearmur and

Doloreux, 2008) and the port industry in Rotterdam (see for example Jacobs et al., 2014). Likewise some KIBS SMEs in the North East and the West Midlands depend on the local manufacturing base and as noted previously, many depend on demand from other services located in the UK and abroad.

Hence, these results indicate that encouragement may to be given to KIBS SMEs which arise out of the scientific, creative and technical labour force in de-industrialised regions. The survey results support the contention that KIBS potential in de-industrialised regions may be found in engineering and design activities based on established industrial, mining or maritime industries and associated trading traditions (see for example Wood, 2010). This potential may also be found in ICT and digital and creative industries, energy and environmental, marketing and financial functions (Wood, 2010). Support may consist of helping KIBS SMEs to access UK and international markets but also building local demand for KIBS services through the provision of domestic public procurement contracting initiatives aimed at local KIBS and supporting technological upgrading of “old” industries.

KIBS Innovation and External Networks

In order to answer research question B, Chapter 6 continued with the exploration of the determinants of KIBS innovation. The effect of various external knowledge sources and their geography was investigated in relation to KIBS innovation activity. It was acknowledged that both internal sources, such as investment in R&D and external sources, such as knowledge sourced from various networks may be important for innovation. Below research sub-questions were tackled in Chapter 6.

5: Which regional sources of knowledge enhance KIBS' innovativeness?

More frequent interaction with local and national client base enhances KIBS innovativeness and this is in line with most other KIBS studies which emphasise the importance of KIBS-client interaction for innovation and knowledge exchange. Also, regional informal and business networks and attendance at conferences and business fairs seem to be conducive for innovation in KIBS.

The innovation capabilities of KIBS SMEs do not seem to be enhanced by frequent interaction with firms in a similar line of business, but more frequent interaction with regional and national consultants and commercial training providers does increase the chances of KIBS innovativeness. Once controlled for the general level of firms' success, regional public knowledge infrastructure and regional universities become a positive predictor of innovativeness, but not a statistically significant one, whereas knowledge interaction with national public and professional knowledge infrastructure, including UK universities, is both positive and significant.

6: Which extra-regional sources of knowledge enhance KIBS' innovativeness?

Descriptive results show that for KIBS, international exchanges are indeed much less important than regional or even national networks. However, the more KIBS engage in networking and sourcing knowledge from international informal contacts, strategic alliances and joint ventures, attending trade fairs and exhibitions overseas, and the more they interact with foreign customers, the greater the probability that they have introduced innovation. Those KIBS that engage in exporting overseas are more likely to be innovators and seem to benefit from more sophisticated international demand.

7: How important is R&D for KIBS' own innovativeness?

A proportion of KIBS invested in R&D (14.6%). However, regression results show that those that did so are more likely to be innovative. Once controlled for endogeneity, investment in R&D ceases to remain a significant predictor of innovation. This implies that there is/are some other, unobserved factor(s) which work(s) together with various sources of external knowledge (listed above) in determining KIBS innovativeness.

The role which KIBS play in the economic development of regions is conditioned on intangibles related to quality of the environment and relationship networks rather than proximity to customers or benefits of agglomeration (Daniels and Bryson, 2005). Results from the analysis conducted in Chapter 6 show that informal contacts and various business institutions such as Chambers of Commerce, Business Link, various professional trade organisations, former Regional Development Agencies are important for KIBS innovativeness. Nevertheless, the importance of international networks and investment in R&D should not be underestimated.

These results are in line with some studies conducted in the UK's South East which emphasise the importance of both local and international networking for innovation (see for example Keeble et al., 1998; Simmie, 1997; Romijn and Albaladeio, 2002).

The Role of KIBS Sub-sectors in Diffusing Knowledge across the Space

In order to answer research question C, Chapter 7 investigated differences and similarities between KIBS sub-sectors from the perspectives of sectoral systems of innovation and differentiated knowledge-bases literature. This chapter emphasises that KIBS do not represent a homogenous sector. In order to address this consideration the following research questions were tackled:

8: Do Computer and related firms and R&D KIBS resemble characteristics of analytic knowledge base?

Computer and related KIBS trade widely, rely on internal software knowledge and source external knowledge mostly locally (within the region) and mainly by informal/non-contractual means as they mostly use business networks and personal contacts. They tend to be strong product/service innovators, drawing from previous employment experience, and are less likely to own registered patents. They are not restricted to city locations hence tend to be more footloose. These KIBS create innovation through use and new combination of existing knowledge, with the intention to solve concrete, context specific problems through user-producer interactions. Analysis in Chapter 7 indicates that Computer and related

KIBS are, contrary to predictions, associated with the synthetic knowledge base rather than analytic knowledge base.

R&D and Technical testing firms are defined by their strong investment in R&D. Compared to other KIBS sub-groups they engage in sourcing external knowledge more extensively both on the regional, UK and international scale. They are more likely to draw external knowledge from Suppliers and Universities within their region but less likely to draw knowledge from Conferences/trade fairs and exhibitions. Overall, they exhibit characteristics of the analytic knowledge base and these results are strongly supported by the data.

9: Do Engineering and Architecture KIBS and Management Consultants resemble characteristics of synthetic knowledge base?

Engineers and Architecture are not likely to be innovators. They are slightly more likely to depend on cities for their location. Investment in R&D is not a defining feature and they are significantly more mature companies with fewer employees. They rely on internal engineering knowledge, drawing external knowledge from local public knowledge infrastructure, and to a lesser extent from overseas sources. They are relatively unlikely to draw from local informal networks, but more from traded, formalised ones, as well as (to some extent) from patents and literature. Engineers trade mostly with regional, UK based and international manufacturing firms and domestic public procurements, whereas Architects largely depend on consumers and public procurement contracts. They do not provide tangible commodities but consultative services hence, key attributes are data exchange, documentation and personal mobility. However, results do not suggest that Engineers and Architects are more likely to be associated with the analytic knowledge base.

Management consultants rely primarily on personal contacts, trust and brand name reputation, but also on more formalised sources such as trade associations and business networks. They are not likely to invest in R&D. Management consultants are significantly less likely to be product/service and process innovators but they are more likely to have introduced marketing innovation. They mostly rely on internal financial and managerial knowledge. Their markets are UK-wide and mainly comprise other services. Unlike their London-based counterparts, they tend to be less active in international markets. They do indeed resemble characteristics of the synthetic knowledge base.

10: Do Advertisers and Publishers differ from synthetic and analytic knowledge base?

The analysis in Chapter 7 shows that Advertisers and Publishers are not significantly different to other KIBS sub-sectors with regards to their respective knowledge base. They share similarities with both synthetic and analytic KIBS sub-groups. It should be noted that due to the data limitations it is not possible to test to what extent do Advertisers and Publishers depend on the symbolic knowledge base.

8.4 Contribution of the Thesis

One of the main contributions of this research is that it improves understanding of the role KIBS play in regional economic development. It is proposed in this thesis that this role consists of (i) KIBS structural role; where KIBS represent a significant export sector in themselves but at the same time facilitate exports and innovation in their customers; (ii) KIBS systemic role; where KIBS act as innovators in their own right as well as a diverse sector which utilises different knowledge bases. Another principal contribution is the original survey. The results of the survey are the key novelty as well as theoretical contribution which relates the literature on knowledge bases to innovation in KIBS.

For a long time geographers have sought to understand how KIBS contribute to wider but often regional systems of innovation. Those geographers who study professional service firms such as consultants, architects, large law firms, advertisers or executive search agencies, have tended to carry out qualitative research in relation to globalisation of these various consultancies and their position in the urban hierarchy (Tether et al., 2012). Other geographers sought to understand what is the potential of

KIBS to de-centralise outside major metropolitan regions, investigating their location and KIBS-client relationships. Another strand of literature examines the effectiveness of KIBS support in aiding innovativeness of manufacturing firms (see for example Camacho and Rodriguez 2007a, 2007b; Evangelista et al., 2013; Evangelista et al., 2015). Other studies deal with KIBS entrepreneurship investigating their specialist client portfolio (see for example Jacobs et al., 2013, 2014).

Interestingly, neither of these scholars (in the more recent past) paid attention to the structural role that KIBS play in de-industrialised regions. Conceptually, the contribution this thesis makes relates to linking sectoral and geographic proximity arguing that to understand KIBS role in regional development, KIBS exporting potential as well as the nature of intermediate demand must be investigated. This research provides novel empirical evidence to aid our understanding of KIBS own exporting potential in de-industrialised regions as well the nature of intermediate demand for their services.

KIBS innovation studies are typically quantitative, covering a range of these activities and have sought to understand the extent to which KIBS innovate and how this innovation differs from the manufacturing industry. Geographers themselves have also tended to follow different methodologies. There are a number of studies which are focusing on micro-economic processes associated with KIBS innovation and their role in regional innovation systems (see for example Aslesen and Isaksen, 2007; Corrocher et al., 2009; Koch and Stahlecker, 2006; Shearmur and Doloreux, 2009; Toivonen and Tuominen, 2009; Doloreux and Shearmur, 2012; Johnston and Huggins, 2015). Current research contributes to a strand of literature which investigates the effect of various external sources of knowledge and networks on KIBS innovativeness and the role of R&D (see for example Leiponen, 2005; Bryson and Monnoyer, 2004; Freel, 2006; Love et al., 2011; Mina et al., 2013). Conceptually, this thesis contributes by joining the literature on networks and KIBS innovation literature. The empirical novelty is related to unique evidence of the role and importance of different types of networks as well as their geography on KIBS innovation.

The third strand of literature is related to differences between KIBS sub-sectors (see for example Den Hertog, 2000; Strambach, 2008; Todtling et al., 2006; Doloreux and Shearmur, 2010; Tether et al., 2012; Consoli and Elche-Hortelano, 2010; Pina and Tether, 2016). In the past, very few studies acknowledged that KIBS are not a homogenous entity but consist of differentiated sub-sectors which share certain similarities but differ with respect to knowledge bases as well as other key characteristics.

A number of more recent studies recognise that KIBS cannot be treated as a homogenous group and further postulates that specific characteristics and knowledge bases underlie separate KIBS sub-sectors. It has been recognised that to study KIBS as a homogenous sector may be misleading and that even broad classification into P-KIBS and T-KIBS may hide considerable variation between the sub-sectors. This thesis contributes to this strand of the literature by providing both novel empirical evidence as well as new theoretical underpinnings on how different KIBS sub-sectors differ in their knowledge bases and other characteristics such as innovation, investment in R&D and location patterns.

Another contribution of this thesis is to bridge the gap between KIBS innovation studies; KIBS studies which investigate the potential of KIBS in regional economic development and KIBS studies which utilise the sectoral systems of innovation perspective. This research makes a specific consideration for both sectoral and geographic proximity arguing that the role of any specific sector or a group of activities can only be fully appreciated if a major consideration is placed on the geographic context within which these sectors operate.

8.5 Implications for Policy

Regional Imbalances in the UK

Regional imbalances have grown much faster in the UK than in other major European countries. As a result by 2003 in the UK there was a notable shift in the view that modern regional policy must focus on improving economic performance of every region by tackling market and social failures that are hindering performance and promoting opportunities for all (DTI, 2003). Furthermore, current discussion regarding spatial rebalancing of the UK economy away from the South East is based on the assumption that policy development and interpretation should be informed by local understanding rather than directed centrally (Bryson and Daniels, 2016).

What followed was a recent programme of decentralization to city regions, including the "Northern Power House" which has sought to address regional disparities, giving cities with elected mayors' revenue-raising powers over local planning and infrastructure development. The ruling orthodoxy draws from the new urban economics and series of policy recommendations that stress how agglomeration processes and urban density create spillovers that are the chief source of productivity growth. According to this orthodoxy, London is an exemplar that other UK cities should follow. Urban areas, it is stated, are growing faster than their hinterlands, but need to grow faster to contribute to rebalancing the UK's economic geography. Policy has become focused on this objective, most notably by loosening land-use planning regulations, promoting metro-mayors and *ad hoc* City and Devolution Deals.

McCann (2016) challenged this urban economics orthodoxy and argued that the performance of cities is crucially dependent on the performance of the region in which they are located. The evidence shows that cities in the South of England (and Scotland) have tended to grow above the national average, while cities in the North grew slower than the national average (McCann, 2016). Many cities do not exhibit the productivity premiums that the orthodoxy claims. This suggests that the urban problem on which policymakers are currently fixated is best understood as a manifestation of the broader regional problem.

This thinking is somewhat in line with the place-based arguments which imply that development strategies should focus on mechanisms that build on local capabilities and promote innovative ideas through the interaction of local and general knowledge, creating multi sectoral policy framework. The place-based approach to regional economic development implies that there are alternative pathways to development (as opposed one size fit all approach) which require institutional, historical and wider place-based context. The place-based strategies for development recognize the need for intervention based on partnerships between different levels of governance. This means that governance arrangements must be vertical or in other words they must traverse the lines between local, regional and national government. The place based arguments also imply that tapping into unused potential in lagging areas is not only important for aggregate growth but can actually enhance growth at both local and national level (Barca et al., 2012).

Modern Industrial Strategy in the UK

In 2010, the Conservative-Liberal Democrat coalition government turned to industrial strategy while searching for ways to stimulate growth and to rebalance the economy. In 2013, the government published its industrial strategy, which contained support for eleven key sectors and eight key technologies including Professional and Business Services (PBS). The sectors were all judged to be strategically important and tradable and with a proven commitment to innovation. Significant opportunities and barriers to growth were also identified in these sectors.

The coalition government recognized PBS as a catalyst of change and innovation in the public and private sectors, transforming business processes and business models across the UK economy. It also noted sector's strong export performance. Following from this, a strategy for PBS was developed by the PBS Council (2013) in collaboration with leading trade and professional bodies. This strategy sets out three areas crucial to growth in the PBS sector in which actions can be taken: Business Environment; Access to Skills; and Developing Overseas Markets and Bringing in New Investment.

The coalition Government also recognised the role of PBS as enablers of local growth and investment, including where they are supporting developments in English Enterprise Zones. Some of these, like Birmingham, Liverpool, Manchester and Bristol, specifically focus on PBS. A regional outreach exercise to eight Local Enterprise Partnerships

(LEPs)[33] in England was undertaken to capture views from the wider PBS community, including SMEs. These endorsed the priorities identified by PBS Council but there was a clear message that contact should be maintained with regional PBS firms to develop understanding of the sector from a local and regional perspective.

Following the 2015 general election, the industrial strategy was downplayed but the frameworks have remained in place. It was argued that the coalition's industrial strategy was too narrow, focusing mainly on high growth, high tech sectors, or those where the UK possesses comparative advantage. The newly formed Department for Business, Energy and Industrial Strategy (BEIS) published a green paper in January 2017 arguing that a modern Industrial Strategy must build on our strengths, make the UK one of the competitive places in the world, and "*close the gap between the UK's most productive companies, industries, places and people and the rest*."

The green paper identifies ten pillars of the new Industrial Strategy with a focus on infrastructure, house-building and measures to raise Britain's stagnating productivity. It should be noted that KIBS are not specific target for this productivity led approach. Instead policies are aiming to address the improvement of the skills, abilities and motivation of the UK labour force, promoting investment in science and technology, finance for growth, infrastructure and R&D. Such policies largely comprise the supply side of the economy.

KIBS and Regional Industrial Strategy

A recent analysis by the ONS (2016) suggests that differences in productivity between regions are not driven by differences in industry composition. For example, firms in London have higher median levels of productivity in most industry sectors when compared with other regions. This suggests that there is a need to understand what factors hinder productivity and innovation in different industries in particular regions. In

[33] Greater Birmingham & Solihull, Leicester & Leicestershire, Leeds City Region, Greater Manchester, Greater Peterborough, Gloucestershire, Liverpool City Region and West of England (Bristol).

other words, there is a scope to base regional development policies on understanding the local context (in line with place-based view) under which particular industries operate. This corresponds to a policy approach which focuses on industrial upgrading within the regional context.

So far, a common form of business support at the regional level has concerned so-called cluster policies, usually taking shape of the support for a set of related industries considered to be of a strategic regional importance (Asheim et al., 2006; Huggins and Williams, 2011). Such policies are usually related to improving linkages, collaboration and cooperation amongst regional actors who undertake activities in related sectors (Huggins and Williams, 2011). In general, regional policy makers have tended to focus on supporting existing clusters of businesses, although some have found problems in effectively identifying working clusters which facilitate regional economic growth (Huggins and Williams, 2011, 917). Future policy in this area seems to lie in fostering networks across universities and local businesses, rather than supporting certain industries.

However, research findings that arise from the analysis of KIBS SMEs survey indicate that important sources of knowledge for KIBS are universities located outside the region, traded relationships (customers) within and outside the region and local and international business and professional networks and informal contacts. Collaboration with related businesses located within the region, however, is not that important for KIBS innovation. These results indicate that sectors differ in relation to the importance of their traded and untraded relationships and regional policies may be tailored to account for such variety with the aim of supporting innovation. The findings also indicate that it does not necessarily follow that university-industry links should be developed locally.

KIBS are particularly important subject of research and policy in this respect as they are not only innovators in their own right but serve as bridges and enablers of innovation in other sectors. Hence, the focus should be placed on building innovation capacity of KIBS by supporting various local and global linkages which enhance KIBS innovativeness rather than focusing solely on promoting investment in R&D.

The findings from this research also challenge the orientation of regional policies which may be focusing on attracting “footloose” sectors to particular locations (Wernerheim and Sharpe, 2003). The findings provide an alternative message for policy in terms of constructing regional advantage (Asheim et al., 2011), arguing that policy should aim to build regional capacity based on existing specialisation. This approach should ensure the technological rejuvenation of traditional sectors and a move towards knowledge-related sectors, which in turn enhance knowledge spill-overs and reinforce innovation ecosystem (Asheim et al., 2011; Meliciani and Savona, 2014). Within this context, an appropriate mix of innovation and industrial policy might favour technological rejuvenation of de-industrialised regions, which would entail an increasing demand for KIBS and upgrading of existing sectoral specialisation toward related but innovative activities (Meliciani and Savona, 2014, 413).

This conclusion stems from the analysis in Chapter 5 which shows that synergies between KIBS and production (manufacturing) are of decisive importance for some KIBS sub-groups such as Engineering and that at least part of KIBS functions must be provided locally. In other words, just as much manufacturing cannot be viewed as the sole object of regional policy, so can KIBS not be stimulated in an isolated way. For most part, a regional service policy should be integrated in a general regional policy. However, it must be noted that for some KIBS (who mostly depend on demand from other, non-local services), there may be a scope for developing separate, national service policies.

The challenge is in identifying whether this translates into developing policies to enhance local provision of services or availability of KIBS expertise which does not necessarily requires co-location between KIBS and their customers. The analysis in Chapter 7 shows that certain types of knowledge do indeed travel further distances. For example, R&D and Technical testing KIBS, which resemble characteristics of the analytic knowledge base, do seem to function at the distance. The results show that their services and knowledge networks are less local, compared to other KIBS. For Engineering KIBS the picture is more complex. Engineering KIBS too resemble characteristics of the analytic knowledge base but their trade partners are mostly located within the region. This is not to say that they do not sell their services internationally, but perhaps initially draw on local demand, develop their niche competencies which then enable them to export their services internationally.

The analysis in Chapter 3 and Appendix III indicates that the regional pattern of KIBS employment has been rather complex in recent years. In many UK regions a certain degree of decentralisation of KIBS has taken place although starting from a relatively low base. Nevertheless, consistent concentration of KIBS in London and the South East persists while an array of KIBS SMEs operates in de-industrialised regions. Finally, efforts may be directed towards supporting existing KIBS. Policies may also focus on investment in infrastructure, suitable education and training policies (upskilling), IT and broadband provision, reduction of the cost of business rents and rates and provision of local amenities with the aim of retaining existing KIBS as well as attracting new KIBS from elsewhere.

8.6 Limitations and Suggestions for Further Research

Finally, it is important to note a few caveats associated with this research. First, and as is typical of the analysis which was employed in Chapter 6 (which explores the effect of different sources of knowledge on KIBS innovativeness), is the key assumption that causation runs from co-operation to innovation. This may be difficult to justify in a cross-sectoral study since the data may be actually capturing the reverse. In other words it is possible that innovative firms are more likely to co-operate compared to non-innovators. Hence, it would be useful to explore the nature of knowledge sourcing practices in greater detail, perhaps through qualitative studies. Secondly, the results presented in Chapter 6 treat KIBS as a homogenous group (even though controlling for differences between P-KIBS and T-KIBS) but it would be useful to dissect the nature of such relationships across KIBS sub-sectors. Larger data set is needed for such exercise. Indeed it may also be useful to compare these findings to the manufacturing firms but also to KIBS located in other countries and other regions.

Another limitation is related to the measure of innovativeness which is a binary variable, noting whether a firm introduced new or improved product/ service or process in the past three years. This measure does not differentiate between different degrees of innovation intensity. However, this is a widely used measure of innovation applied also in the Community Innovation Survey and many other studies which utilise survey methodology.

This research uses survey data. There are two possible sources of error in surveys: sampling error and non-sampling error. Sampling error is the difference between the population and the sample. In other words how representative is the sample of its population? In Chapter 4 the KIBS sample is compared to the population of KIBS in the North East and the West Midlands. The results show that the sample is very close to the population with regards to sub-sectoral representation. However, non-sampling error may arise if sampling strategy is inadequate and may arise as a result of non-response. Dealing with this type of a problem (non-response) is not easy. In the initial data collection it has been identified that larger firms (over 10 but not more than 249 employees) were more likely to refuse participation in the survey.

To overcome this problem the sample was enhanced by the additional sub-sample of the relatively larger firms (over 5 employees) in order to minimise this type of non-response bias. Also, a number of firms did not provide information on their revenue hence, the analysis in Chapter 5 is based on a smaller sample. This also applies to the analysis in Chapters 6 and 7 due to the fact that not all 342 KIBS SMEs provided all the answers to the external knowledge sourcing questions. Another way to deal with the possible non-response bias is to compare the main firms' characteristics and results with the results from other surveys of SMEs.

One implication which arises as a result of this research is that it is important not to underestimate the issue of place and space when analysing KIBS functions. Also, the extent to which KIBS should be disaggregated into separate sub-sectors should be an important consideration in future research. The division between P-KIBS and T-KIBS is a starting point. Some studies do use standard industrial classification to dismantle an array of KIBS (see for example Doloreux and Shearmur, 2012) but even then important differences may not be revealed. For example, the analysis in Chapter 5 shows that important differences exist between Engineers and Architects with regards to the sources of the demand for these two groups (note that these two groups are usually put together in any standard industrial classification). However, the preliminary analysis showed that these two groups exhibit some notable similarities in relation to their knowledge sourcing practices hence, they were treated as a single unit in Chapter 7. Any future research should take such differences and similarities into consideration when drawing research conclusions.

Also, the role and importance of large globalised KIBS has been overemphasised in previous KIBS research and this study has shown that KIBS located in de-industrialised regions may not be global leaders but rather providers of support and integral players within their region and the UK economy. It should be noted, however, that benefits and opportunities which arise from having international customers and being part of international networks should not be underestimated.

Another contribution this research makes is related to new insights with regards to different knowledge bases underpinning KIBS sub-sectors. This also raises questions as to whether there may be some other, unrecognised forms of knowledge or perhaps combinations of knowledge and how applicable these may be to different types of KIBS or other industries. Further research should address this issue.

In summary, future KIBS research should aim to identify their strategic role in relation to production, consumption and contribution to other sectors. This is because KIBS supply expertise and enhance the competitiveness of other sectors (Marshall, 1988, 252). Their economic contribution can therefore only be evaluated in relation to improved performance they induce in their customers. Hence, one of the most important limitations of this research is that it is not designed to provide deep insights into the nature and characteristics of the relationship between KIBS and clients. This type of analysis calls for further, qualitative research.

8.7 Conclusion

The results from the analysis of the West Midlands and the North East KIBS SMEs survey show that KIBS in de-industrialised regions provide mostly indirect support to their regional clients. The findings from this study also indicate that even though KIBS are active UK wide and to an extent in international markets, many KIBS largely depend on regional demand. It seems that a large number of KIBS SMEs complement the underlying regional industrial specialisation. In the North East and the West Midlands, for example, this specialisation includes other services but also a comparatively strong manufacturing base. Hence, the evidence indicates that the modern geography of the UK KIBS, even though dominated by London and the South East, is actually rather varied. This geography reflects a variation in demand profiles found in different regions.

And even though the results show that KIBS in de-industrialised regions largely depend on local demand, it is clear that a majority (79%) export their services outside their region, and many (25%) export their services abroad. These are services based largely on information which can be sold over increasingly long distances, so that firms can locate further away from their customer base. This implies that local economic development also depends on promoting local conditions such as IT provision, transport and communication infrastructure, education systems and cultural amenities, often found to attract professional firms to prosperous regions. Indeed this research confirms that two of most important location decisions for KIBS SMEs are good quality of life and availability of local amenities.

This thesis also provides some original evidence regarding the relationship between inter-firm cooperation and innovation. One of the main differences between this and similar studies is its multi-dimensional approach to both data collection and data analysis. This allowed additional information to be captured in the construction of the original variables, relating particularly to the range and extent of co-operative relations and knowledge sourcing as well as their respective geographies. While the results show that sourcing knowledge from external sources is important, they also indicate that it is a frequency of this interaction that matters.

The finding that vertical ties with customers have a positive impact on innovation is in line with many previous KIBS studies which confirm the importance of user-provider interaction. The findings also suggest that policy initiatives should concentrate on strengthening regional networking initiatives, and co-operation with UK universities. The importance of international connectedness, in terms of both commercial and informal ties, should not be underestimated. However, the role of R&D does not seem to play a major role in KIBS SMEs innovativeness. This does not necessarily mean that R&D is not important but that other success factors may work in combination with external sources to support innovation.

There are different routes to analysing the composition of industries and sectors such as the output they produce (products and innovations) or/and the inputs they use (labour, capital, intermediate inputs, knowledge) (Consoli and Elche-Hortelano, 2010). KIBS comprise of differentiated sub-sectors and one of the aims of this thesis was to utilise the knowledge taxonomy developed by Asheim and colleagues. Hence, some theoretical assumptions about the nature and geography of knowledge as divided into: analytic, synthetic and symbolic were tested.

The results show that this particular knowledge taxonomy may be useful in classifying KIBS but also that some KIBS sub-sectors possess characteristics which do not necessarily coincide with their expected knowledge base. For example, Engineering firms are expected to spatially co-locate with customers and external sources of knowledge. The survey results show, however, that they have a wider customer base. Also, Engineers are less likely to use informal contacts. This and other knowledge sourcing practices (reported in Chapter 7) bring them closer to the analytic knowledge base. Computer and related KIBS are assumed to resemble primarily characteristics of the analytic knowledge base but the analysis in Chapter 7 indicates that they are mostly associated with the symbolic knowledge.

One group which falls neatly into its predicted knowledge base (analytic) is R&D and Technical testing KIBS. It should be noted that when R&D and Technical testing firms are compared to another analytic group- Engineering and Architects, they tend to be much more internationally orientated. This suggests that even though analytic knowledge does on average travel further distances there may be variation between different analytic groups in relation to the extent to which they may be free from geographical constraints. These examples show that KIBS are multifaceted and that classification into analytic, symbolic and synthetic knowledge bases (although useful) has its limitations.

Also, accumulation of knowledge is an incremental process whose character is best appreciated from a long term perspective, perhaps using longitudinal data. A question to be tackled in future research therefore asks whether patterns of sectoral specification display any form of continuity and how they may change with time and for different KIBS sub-sectors.

It follows from the empirical and conceptual evidence reviewed from the rest of the literature that services and KIBS in particular cannot be regarded as a panacea for regional growth in lagging or de-industrialised regions. Although there are specific exemptions including a relative trend towards decentralisation, as observed in Chapter 2 and Appendix III, KIBS generally continue to be highly concentrated in London and the South East. Nevertheless, it is useful to explore a possible KIBS oriented regional economic strategy and elements that it may include.

Perhaps the first point should concern the degree of complementarity between goods and KIBS. Indeed a number of studies investigate the effect which interaction with KIBS has on manufacturing competitiveness (see for example Camacho and Rodriguez 2007a, 2007b; Evangelista et al., 2013; Evangelista et al., 2015). This line of research is in tune with some pioneering studies which have conclusively demonstrated the existence of close interdependencies between manufacturing and KIBS (see for example Gershuny, 1978; Gershuny and Miles, 1983). Therefore, it follows that any regional policy focused on either "productive" activities or KIBS in isolation may be sub-optimal.

This thinking is in line with the demand side approach to regional policy which consists of generating sufficient demand to stimulate the initial creation and subsequent growth of KIBS. The growth of Engineering services in particular areas in the North East and the West Midlands is a good example of the demand side stimulus. Engineering KIBS in these two regions provide specialised and tradable services which are derived from a long tradition and local expertise in the primary or manufacturing sector.

In the UK there has been, to some extent, a coordinated effort to build new industries on old formations. For example, the former RDA-One North East directly supported firms that built on the capacity of former industries. The former One North East and Yorkshire Forward provided direct support to the Newcastle's Marine Design Centre whose goal was to create a new industry from the shipbuilding that existed in the North East for hundreds of years. The Marine Design Centre has established an R&D programme with the University of Newcastle, conducted seminars for the marine designers, developed skill training programmes and provided important marketing role for small firms enabling them to compete in the international markets (Christopherson, 2009).

There are other examples across the UK, however, there seem to be more scope for similar types of initiatives to provide basis for regional demand promotion, which would support local KIBS entrepreneurship. Such types of initiatives apply particularly to Engineering KIBS. Further support may consist of helping SMEs to access UK and international markets, but also building local demand for KIBS services through the provision of accessible public procurement contracting initiatives aimed at local SMEs.

The findings in Chapter 6 show that external knowledge generated from customers located within the region, UK or abroad plays a significant factor in KIBS' innovativeness. Hence, evidence suggest that while initially focusing on broadly regional and adjacent demand, if of sufficient quality, this may become the basis of national and even international KIBS expansion (O'Farrell et al., 1996). In this case encouragement may be given to KIBS SMEs who arise out of scientific, creative, technical and commercial, local labour force in de-industrialised regions. This support may also consist in promoting various networks and collaboration for innovation.

However, any attempt to create an effective KIBS policy in de-industrialised regions needs to be grounded in a better understanding of the economics of KIBS and factors governing the location and innovation of these activities. Further, such policies should be in line with national science and technology policy and the new forms of international competition. It should also be noted that expending too much effort on trying to resist markets trends may not be worthwhile but further research should continue to address approaches to KIBS in light of the dynamics underpinning KIBS potential in regional development outside London and the South East. Further research is needed as during and after the most recent economic downturn the pattern of regional uneven development is continuing to shape the UK economic landscape and KIBS continue to contribute towards reinforcing this persistent inequality.

APPENDIX I: MAIN VARIABLES: COMPARISON BETWEEN THE NORTH EAST AND THE WEST MIDLANDS

Table I

Region		N	Mean	Std. Deviation	Std. Error Mean
Company Age and Company Size Variables					
Company age	North East	165	18.81	22.110	1.721
	West Midlands	174	15.01	20.362	1.544
Number of employees	North East	167	13.92	34.305	2.655
	West Midlands	175	10.76	32.279	2.440
KIBS Tradability Variables					
If selling outside the region	North East	135	.7852	.41222	.03548
	West Midlands	122	.7951	.40531	.03669
If exporting abroad	**North East**	**134**	**.2090**	**.40809**	**.03525**
	West Midlands	**122**	**.2869**	**.45417**	**.04112**
Whether firm located in the city or elsewhere					
Located in city	North East	167	.26	.439	.034
	West Midlands	175	.29	.453	.034
Innovation Activity Variables					
R&D to sales ratio	North East	129	4.09	14.533	1.280
	West Midlands	139	5.53	17.632	1.496
R&D	North East	130	.20	.402	.035
	West Midlands	140	.17	.378	.032
Product or Service Innovation	**North East**	**165**	**.39**	**.490**	**.038**
	West Midlands	**175**	**.49**	**.501**	**.038**
Process Innovation	North East	164	.33	.471	.037
	West Midlands	175	.32	.468	.035
Marketing Innovation	North East	164	.37	.485	.038
	West Midlands	175	.39	.490	.037
External Sources of Knowledge Variables					
Customers within the region	**North East**	**158**	**4.47**	**3.194**	**.254**
	West Midlands	**171**	**4.18**	**3.249**	**.248**
Suppliers within the region	North East	158	3.26	2.758	.219
	West Midlands	171	2.91	2.662	.204
Rival firms within the	**North East**	**159**	**2.50**	**2.074**	**.164**

region	**West Midlands**	**171**	**2.25**	**2.086**	**.160**
Employment within the region	**North East**	**150**	**2.19**	**2.175**	**.178**
	West Midlands	**162**	**1.67**	**1.751**	**.138**
Licences within the region	**North East**	**153**	**1.71**	**1.600**	**.129**
	West Midlands	**168**	**1.70**	**1.757**	**.136**
Consultants within the region	North East	157	3.01	2.547	.203
	West Midlands	171	2.47	2.159	.165
Formal strategic alliances/joint ventures within the region	North East	158	2.94	2.527	.201
	West Midlands	171	2.78	2.600	.199
Public sector organisations within the region	**North East**	**158**	**3.15**	**2.727**	**.217**
	West Midlands	**171**	**2.66**	**2.474**	**.189**
Private sector organisations, such as private training or research providers and consultants within the region	North East	157	3.31	2.659	.212
	West Midlands	171	2.87	2.564	.196
Literature/patents within the region	North East	157	3.03	2.780	.222
	West Midlands	171	2.74	2.550	.195
Conferences, trade fairs, exhibitions within the region	North East	159	3.13	2.534	.201
	West Midlands	171	3.06	2.477	.189
Professional and trade associations within the region	North East	158	3.97	2.998	.238
	West Midlands	171	3.02	2.564	.196
Universities or other higher education institutes within the region	North East	156	2.88	2.466	.197
	West Midlands	171	2.35	2.261	.173
Contract research within the region	North East	155	1.65	1.427	.115
	West Midlands	170	1.52	1.607	.123
Research cooperation within the region	North East	155	1.55	1.406	.113
	West Midlands	170	1.43	1.397	.107
Business networks within the region	North East	159	3.03	2.658	.211
	West Midlands	171	2.93	2.625	.201
Informal contacts within the region	**North East**	**159**	**4.84**	**2.999**	**.238**
	West Midlands	**171**	**4.91**	**3.033**	**.232**
Customers elsewhere in the UK	North East	156	3.72	3.198	.256
	West Midlands	171	3.75	3.248	.248
Suppliers elsewhere in the UK	North East	157	2.87	2.747	.219
	West Midlands	172	2.63	2.607	.199
Rival firms elsewhere in	**North East**	**158**	**2.22**	**2.131**	**.170**

the UK	**West Midlands**	**172**	**1.88**	**1.714**	**.131**
Employment elsewhere in the UK	North East	154	1.68	1.691	.136
	West Midlands	163	1.48	1.403	.110
Licences elsewhere in the UK	North East	154	1.60	1.709	.138
	West Midlands	169	1.55	1.581	.122
Consultants elsewhere in the UK	North East	156	2.28	2.338	.187
	West Midlands	172	1.94	1.805	.138
Formal strategic alliances/joint ventures elsewhere in the UK	North East	157	2.26	2.402	.192
	West Midlands	172	2.30	2.362	.180
Public sector organisations elsewhere in the UK	North East	157	2.48	2.516	.201
	West Midlands	172	2.17	2.222	.169
Private sector organisations, such as private training or research providers and consultants elsewhere in the UK	North East	157	2.67	2.671	.213
	West Midlands	172	2.24	2.245	.171
Literature/patents elsewhere in the UK	North East	158	2.59	2.783	.221
	West Midlands	172	2.25	2.287	.174
Conferences, trade fairs, exhibitions elsewhere in the UK	North East	158	2.82	2.632	.209
	West Midlands	172	2.65	2.369	.181
Professional and trade associations elsewhere in the UK	North East	158	2.99	2.726	.217
	West Midlands	172	2.69	2.546	.194
Universities or other higher education institutes elsewhere in the UK	North East	157	2.01	2.047	.163
	West Midlands	172	1.92	1.890	.144
Contract research elsewhere in the UK	North East	157	1.52	1.470	.117
	West Midlands	172	1.35	1.287	.098
Research cooperation elsewhere in the UK	North East	157	1.52	1.571	.125
	West Midlands	172	1.28	1.084	.083
Business networks elsewhere in the UK	North East	158	2.19	2.269	.181
	West Midlands	172	2.31	2.243	.171
Informal contacts elsewhere in the UK	North East	158	3.68	3.144	.250
	West Midlands	172	4.11	3.202	.244
Customers overseas	North East	158	1.70	2.107	.168
	West Midlands	171	1.84	2.240	.171
Suppliers overseas	North East	159	1.40	1.369	.109
	West Midlands	173	1.77	2.205	.168
Rival firms overseas	North East	159	1.14	.750	.060

	West Midlands	173	1.31	1.366	.104
Employment overseas	North East	156	1.12	.739	.059
	West Midlands	172	1.08	.753	.057
Licences overseas	North East	157	1.11	.721	.058
	West Midlands	172	1.20	1.168	.089
Consultants overseas	North East	158	1.13	.822	.065
	West Midlands	173	1.20	1.034	.079
Formal strategic alliances/joint ventures overseas	North East	158	1.30	1.399	.111
	West Midlands	172	1.37	1.533	.117
Public sector organisations overseas	North East	157	1.11	.698	.056
	West Midlands	173	1.14	.874	.066
Private sector organisations, such as private training or research providers and consultants overseas	North East	156	1.22	1.162	.093
	West Midlands	173	1.26	1.119	.085
Literature/patents overseas	North East	158	1.38	1.517	.121
	West Midlands	173	1.50	1.784	.136
Conferences, trade fairs, exhibitions overseas	North East	159	1.37	1.434	.114
	West Midlands	173	1.69	2.090	.159
Professional and trade associations overseas	North East	159	1.28	1.196	.095
	West Midlands	173	1.38	1.496	.114
Universities or other higher education institutes overseas	North East	157	1.15	.846	.068
	West Midlands	173	1.17	.915	.070
Contract research overseas	North East	158	1.13	.783	.062
	West Midlands	173	1.17	1.112	.085
Research cooperation overseas	North East	157	1.15	.783	.062
	West Midlands	173	1.13	.915	.070
Business networks overseas	North East	159	1.21	1.068	.085
	West Midlands	173	1.29	1.252	.095
Informal contacts overseas	North East	158	1.82	2.242	.178
	West Midlands	173	1.55	1.878	.143
Location Decision Variables					
Proximity to customers	North East	149	3.0201	2.94194	.24101
	West Midlands	169	2.7337	3.05604	.23508
Proximity to suppliers	North East	149	1.9060	1.88286	.15425
	West Midlands	169	1.6923	1.79616	.13817

Availability of local professional/skilled staff	North East	149	2.9396	2.87164	.23525
	West Midlands	169	2.5444	2.75370	.21182
Proximity to other firms in the industry	North East	149	2.0403	2.01306	.16492
	West Midlands	169	1.9822	2.29252	.17635
Availability of local informal networks	**North East**	**147**	**2.6395**	**2.52100**	**.20793**
	West Midlands	**169**	**2.3432**	**2.51199**	**.19323**
Availability of local business networks	**North East**	**149**	**2.6846**	**2.46348**	**.20182**
	West Midlands	**169**	**2.1479**	**2.33924**	**.17994**
Good international connectivity	North East	149	2.2953	2.51349	.20591
	West Midlands	169	2.1953	2.58493	.19884
Low cost of support staff/premises/business rates	**North East**	**149**	**3.4564**	**3.16331**	**.25915**
	West Midlands	**168**	**3.5298**	**3.60127**	**.27784**
Proximity to owner's/manager's home	North East	149	8.1611	2.90169	.23772
	West Midlands	169	7.6509	3.54764	.27290
Good quality of life	**North East**	**149**	**6.3826**	**3.87577**	**.31752**
	West Midlands	**168**	**6.1190**	**4.12210**	**.31803**

APPENDIX II: KIBS SUB-SECTORS: LOCATION QUOTIENTS BY LOCAL AUTHORITY

Table 2.15: Location Quotients by Local Authority, 2011

Professional, scientific and technical activities (SIC, M)		
London	City of London	3.3
London	Camden	2.9
South East	South Oxfordshire	2.7
London	Southwark	2.6
London	Islington	2.4
London	Westminster	2.3
South East	Bracknell Forest	2.3
East of England	South Cambridgeshire	2.2
South East	Mole Valley	2.2
London	Richmond upon Thames	2.2
South East	Woking	2.1
South East	Vale of White Horse	2.1
Scotland	Aberdeen City	1.9
South East	Elmbridge	1.8
South East	Runnymede	1.8
East of England	St Albans	1.8
South East	Chiltern	1.8
South East	Reading	1.7
London	Hammersmith and Fulham	1.7
North West	Manchester	1.7
West Midlands	**Stratford-on-Avon**	**1.6**
East of England	Watford	1.6
London	Hackney	1.6
South East	Windsor and Maidenhead	1.6
South East	Guildford	1.6
North West	Cheshire East	1.6
South East	Wycombe	1.6
South East	Epsom and Ewell	1.6
South East	Rushmoor	1.6
South East	South Bucks	1.5

North West	Trafford	1.5
North West	Fylde	1.5
East of England	Cambridge	1.5
South East	Wokingham	1.5
Scotland	Midlothian	1.5
West Midlands	**Warwick**	**1.4**
London	Kensington and Chelsea	1.4
East of England	Dacorum	1.4
Scotland	Aberdeenshire	1.4
East Midlands	Blaby	1.4
South East	Waverley	1.4
East of England	Brentwood	1.4
West Midlands	**Malvern Hills**	**1.4**
South East	Sevenoaks	1.4
London	Harrow	1.3
Yorkshire and The Humber	Leeds	1.3
London	Tower Hamlets	1.3
North West	Warrington	1.3
East Midlands	Rushcliffe	1.3
South East	Winchester	1.3
South East	Surrey Heath	1.3
South West	South Gloucestershire	1.3
South West	Exeter	1.3
East of England	East Hertfordshire	1.3
South East	Milton Keynes	1.3
London	Hounslow	1.3
South West	Bristol, City of	1.3
East of England	Three Rivers	1.3
London	Wandsworth	1.3
Yorkshire and The Humber	Ryedale	1.2
South East	Hart	1.2
South East	Reigate and Banstead	1.2
Yorkshire and The Humber	Craven	1.2
East Midlands	South Northamptonshire	1.2
London	Hillingdon	1.2
North East	**Stockton-on-Tees**	**1.2**
East of England	Welwyn Hatfield	1.2

East of England	Forest Heath	1.2
East of England	Hertsmere	1.2
Scotland	Edinburgh, City of	1.2
London	Croydon	1.2
London	Kingston upon Thames	1.2
South East	West Oxfordshire	1.2
West Midlands	**Rugby**	**1.2**
West Midlands	**Solihull**	**1.2**
South East	Horsham	1.2

Source: Office for National Statistics

Table 2.16: Location Quotients by Local Authority, 2011

Architectural and engineering activities; technical testing and analysis (SIC, 71)		
Scotland	Aberdeen City	6.2
Scotland	Aberdeenshire	4.6
South East	Epsom and Ewell	3.9
East of England	Great Yarmouth	3.7
West Midlands	**Stratford-on-Avon**	**3.7**
South East	Mole Valley	3.7
North West	Copeland	3.0
South East	Test Valley	2.9
North West	Warrington	2.8
West Midlands	**Rugby**	**2.8**
East of England	South Cambridgeshire	2.8
South East	Vale of White Horse	2.6
South East	Wokingham	2.6
London	Islington	2.5
North East	**Stockton-on-Tees**	**2.5**
South East	South Oxfordshire	2.3
South East	Adur	2.3
East Midlands	South Derbyshire	2.2
East of England	Huntingdonshire	2.2
Yorkshire and The Humber	Selby	2.1
South East	Waverley	2.1
Scotland	Angus	2.1
East Midlands	Kettering	2.1
London	Richmond upon Thames	2.1
South East	Rushmoor	2.0
East Midlands	Rushcliffe	2.0
East Midlands	Derby	2.0
East of England	Maldon	2.0
North West	Halton	2.0
London	Camden	1.9
South East	Woking	1.9
Wales	Anglesey	1.9
South East	Wycombe	1.8
South West	Taunton Deane	1.8
London	Croydon	1.7
London	Southwark	1.6
East of England	Central Bedfordshire	1.6
South West	Tewkesbury	1.6
East of England	Cambridge	1.6

East Midlands	Blaby	1.6
East Midlands	Broxtowe	1.6
London	Wandsworth	1.6
South West	Purbeck	1.6
East of England	Mid Suffolk	1.6
South East	West Oxfordshire	1.6
South East	Guildford	1.6
South East	Surrey Heath	1.6
East of England	St Albans	1.5
East of England	Welwyn Hatfield	1.5
South West	South Gloucestershire	1.5
West Midlands	**Warwick**	**1.5**
London	Hammersmith and Fulham	1.5
South West	Cotswold	1.5
South East	Eastleigh	1.5
South West	Bath and North East Somerset	1.5
East Midlands	Chesterfield	1.5

Source: Office for National Statistics

Table 2.17: Location Quotients by Local Authority, 2011

Computer programming, consultancy and related activities (SIC, 62)		
South East	Wokingham	7.0
South East	Rushmoor	5.2
South East	Slough	4.7
South East	Mole Valley	4.4
South East	Reading	4.3
South East	Woking	3.9
South East	Runnymede	3.8
South East	Spelthorne	3.4
South East	Bracknell Forest	3.4
South East	Windsor and Maidenhead	3.3
South East	West Berkshire	3.1
South East	Hart	3.1
East of England	Dacorum	2.9
South East	Wycombe	2.9
South East	Portsmouth	2.8
London	Richmond upon Thames	2.7
South East	Milton Keynes	2.7
London	Tower Hamlets	2.6
London	Lambeth	2.5
London	Hounslow	2.5
South East	Winchester	2.4
East of England	South Cambridgeshire	2.4
London	Harrow	2.3
South East	Elmbridge	2.3
South East	Waverley	2.3
South East	Guildford	2.3
West Midlands	**Solihull**	**2.2**
London	Islington	2.2
West Midlands	**Warwick**	**2.1**
South East	Basingstoke and Deane	2.1
London	Hammersmith and Fulham	2.1
South East	Surrey Heath	2.1
London	City of London	2.1
East of England	Cambridge	2.0
East of England	Stevenage	2.0
West Midlands	**Telford and Wrekin**	**2.0**
South East	Chiltern	2.0
London	Kingston upon Thames	2.0
South East	Vale of White Horse	2.0

London	Wandsworth	2.0
East of England	Three Rivers	1.9
South East	Havant	1.9
London	Westminster	1.9
London	Camden	1.8
London	Merton	1.8
London	Southwark	1.7
South East	South Oxfordshire	1.7
East Midlands	Broxtowe	1.7
London	Hackney	1.7
South West	Christchurch	1.7
East of England	St Albans	1.7
London	Redbridge	1.6
South East	Horsham	1.6
East Midlands	Rushcliffe	1.6
South West	Cotswold	1.6
London	Barnet	1.6
North West	Chorley	1.5
East Midlands	South Northamptonshire	1.5
South East	East Hampshire	1.5
South East	Eastleigh	1.5
East Midlands	Chesterfield	1.5
Scotland	Inverclyde	1.5
East of England	Basildon	1.5
London	Bromley	1.5
North East	**Newcastle upon Tyne**	**1.4**

Source: Office for National Statistics

Table 2.18: Location Quotients by Local Authority, 2011

Activities of head offices; management consultancy activities (SIC, 70)		
London	Westminster	3.7
South East	Elmbridge	3.4
East Midlands	Blaby	3.3
East of England	Dacorum	3.0
East of England	St Albans	2.9
South East	Bracknell Forest	2.9
South West	South Gloucestershire	2.7
South East	Mole Valley	2.7
East Midlands	Bolsover	2.7
South East	Runnymede	2.7
South East	Woking	2.7
South East	Chiltern	2.5
South East	Milton Keynes	2.5
South East	Windsor and Maidenhead	2.5
London	Richmond upon Thames	2.4
East of England	Three Rivers	2.3
London	City of London	2.3
London	Kensington and Chelsea	2.3
East of England	Southend-on-Sea	2.2
South East	Guildford	2.2
South East	Hart	2.1
London	Hillingdon	2.1
East of England	Watford	2.1
London	Camden	2.0
South East	South Bucks	2.0
North West	Rochdale	2.0
London	Southwark	2.0
South East	South Oxfordshire	2.0
East of England	Hertsmere	1.9
North West	Manchester	1.9
South East	Slough	1.9
London	Hounslow	1.8
South East	Fareham	1.8
London	Tower Hamlets	1.8
London	Kingston upon Thames	1.7
East of England	Forest Heath	1.7
London	Islington	1.7
South West	Mendip	1.7
East of England	East Hertfordshire	1.7

South East	Tandridge	1.6
South East	Waverley	1.6
South East	Rushmoor	1.6
South East	West Oxfordshire	1.6
West Midlands	**North Warwickshire**	**1.6**
East Midlands	Charnwood	1.5
London	Hammersmith and Fulham	1.5
South West	Tewkesbury	1.5
East Midlands	East Northamptonshire	1.5
South East	Wokingham	1.5
North West	Cheshire East	1.5
North East	**Middlesbrough**	**1.5**
South East	Surrey Heath	1.5
South East	Wycombe	1.5
North West	Trafford	1.4
East Midlands	South Northamptonshire	1.4
East Midlands	Bassetlaw	1.4
West Midlands	**Warwick**	**1.4**
South West	East Dorset	1.4
West Midlands	**Solihull**	**1.4**
South East	Eastleigh	1.4
North West	Warrington	1.4
West Midlands	**Stratford-on-Avon**	**1.3**

Source: Office for National Statistics

Table 2.19: Location Quotients by Local Authority, 2011

Scientific research and development (SIC, 72)		
East of England	South Cambridgeshire	17.9
South East	Vale of White Horse	13.5
Scotland	Midlothian	11.0
South East	Bracknell Forest	10.9
East of England	Cambridge	7.3
London	Richmond upon Thames	5.8
North West	Cheshire East	5.3
South West	Wiltshire	4.9
South East	Horsham	4.7
South East	South Oxfordshire	4.6
South East	Surrey Heath	4.6
South East	Runnymede	4.5
London	Camden	3.7
London	Hillingdon	3.6
East of England	South Norfolk	3.5
East of England	Hertsmere	3.4
South East	Slough	3.3
North East	**Stockton-on-Tees**	**3.1**
East of England	Uttlesford	3.0
East Midlands	Charnwood	2.9
South East	Chiltern	2.9
South East	Reading	2.9
East of England	Bedford	2.8
North East	**Redcar and Cleveland**	**2.6**
South East	Windsor and Maidenhead	2.5
South West	Swindon	2.5
London	Islington	2.4
London	Hammersmith and Fulham	2.4
Scotland	West Lothian	2.3
South East	Wokingham	2.2
Scotland	Dundee City	2.0
North West	Halton	2.0
North West	Chorley	1.9
North West	Cheshire West and Chester	1.8
East of England	St Albans	1.7
South East	Guildford	1.7
Scotland	Stirling	1.6
London	Westminster	1.6
South East	South Bucks	1.6

Scotland	Orkney Islands	1.6
London	Brent	1.6
South East	Oxford	1.5
London	Hackney	1.5
London	Barnet	1.4
Wales	Flintshire	1.4
North East	**County Durham**	**1.4**

The West Midlands and the North East KIBS Specialisation by Local Authority (LA)

Table 2.15 shows that in the West Midlands KIBS account for higher than average concentration in the following local authorities: Stratford-on-Avon (LQ, 1.5), Warwick (LQ, 1.5), Malvern Hills (LQ, 1.4), Rugby and Solihull (LQ, 1.2). Stratford-on-Avon, Solihull and Warwick all sit in a relatively close proximity to London and Reading where they benefit from access to wider South East demand for their services. One LA in the North East where KIBS have relatively high LQ (1.2) is Stockton-on-Tees. Stockton-on-Tees is one of the fastest growing economies in the North East with past history of ship building and railways, steel and chemicals and has recently benefited from government investment in infrastructure and business support.

Table 2.16 shows that the following LAs show concentration of Architectural and engineering activities and technical testing and analysis: Stratford-on-Avon (LQ, 3.7), Rugby (LQ, 2.8) and Warwick (LQ, 1.5) in the West Midlands and Stockton on Tees (LQ, 2.5) in the North East. Rugby is an engineering centre with a long history of producing gas and steam turbines. Rolls Royce engineering works in Ansty are nearer to Coventry than Rugby but they provide employment for many people who reside in Rugby. Stratford-upon-Avon has a well-diversified economy and as well as tourism, it has developed boat building industry and mechanical and technical engineering.

Table 2.17 indicates that Computer programming and related consultancy is relatively concentrated in the following LAs: Solihull (LQ, 2.2), Warwick (LQ, 2.2) and Telford and Wrekin (LQ, 2) In the West

Midlands and Newcastle upon Tyne (LQ, 1.4) in the North East. Telford and Wrekin is relatively prosperous LA with persistent lower than the West Midlands average unemployment and lower than UK average unemployment. The knowledge economy sector (SOC2010 groups 1-3) in Telford and Wrekin makes up 37.5% of the workforce, with an estimated 29,700 people in employment (compared to 40.6% in the West Midlands and 44.8% in England) in January 2016. In the North East there is a growing cluster of technology businesses in Newcastle which supply software solutions to a wide range of businesses such as banks, engineering companies, accountants, GP surgeries, NHS, housing associations and the public sector (NELEP, 2012, 59). In recent years, the region has seen more technology company start-ups than any area of the UK outside London (NELEP, 2012, 59).

Table 2.18 shows concentration of Management consultancy and activities of head offices. It can be seen that relative concentration in this KIBS sub-sector is evident in: North Warwickshire (LQ, 1.6), Warwick (LQ, 1.4), Solihull (LQ, 1.4) and Stratford-on-Avon (LQ, 1.3) in the West Midlands; and Middlesbrough (LQ, 1.5) in the North East. Apart from strong presence of chemicals, Middlesbrough also remains a stronghold for engineering based manufacturing and engineering contract service businesses. It also has a growing reputation for developing digital businesses particularly in the field of digital animation. This is mostly related to spin-out activity, in this new industry, from the Middlesbrough-based Teesside University.

Table 2.19 shows that Scientific research and development sector is concentrated in three LAs in the North East (Stockton-on-Tees, LQ, 3.1; Redcar and Cleveland, LQ, 2.6 and County Durham, LQ, 1.4). Redcar and Cleveland has developed a strong steel and chemical industry but recent job losses in the steel industry may negatively affect employment in research and development in these LAs.

APPENDIX III: KIBS BEFORE THE 2008 RECESSION

3.1 Introduction

This section presents location trends and characteristics of KIBS at the national, regional and sub-regional level and it aims to identify main themes (what sectors are involved, what percentage of regional employment is accounted for by KIBS and to provide time-series analysis of changes in KIBS employment from 2000 to 2008.

The data used in this analysis is based on the Office for National Statistics' Interdepartmental Business Register (IDBR)[34] and covers the period from March 2000 to March 2008. IDBR covers all businesses, other than some very small businesses (self-employed and those without employees and low turnover). Those excluded are not VAT registered and fall below the compulsory turnover threshold of £60,000. However with 2,1million businesses covered it provides more than 99% coverage of UK economic activity. Most other studies on the UK KIBS location use largely former Annual Business Inquiry (ABI), or more recent version- BRES, which is a survey of UK enterprises. ABI suffers from a notable disadvantage in comparison to IDBR and this is due to ABI's incomplete sampling at lower geographical areas such as local authorities and counties.

However, it should be noted that IDBR employment figures represent an aggregated value from all of the sites that the business owns. For example, for a bank whose headquarters are located in London the employment figure includes not just London employees but also those bank's employees who are located in different bank's branches outside London. As the bank is headquartered in London it is reporting on behalf of all of its sites regardless of where these sites are located. Hence, a significant fall in employment in the financial industry from 2000 to 2008 should be interpreted with caution. This may mean that the significant proportion of the fall in employment may have happened in branch plants

[34] IDBR covers all businesses, other than some very small businesses (self-employed and those without employees and low turnover). Those excluded are not VAT registered and fall below the compulsory turnover threshold. However, with 2,1 million of businesses covered, it provides more than 99% coverage of the UK economic activity.

located outside London. It follows that IDBR is more suitable for the type analysis which considers numbers of enterprises (units) rather than employment figures. Also, ABI data is based on estimates whereas IDBR provides full count of all enterprises eligible for VAT reporting hence, ABI is more suited for analysis of employment rather than numbers of units. Table 3.1 lists the KIBS sectors included in the analysis in the Appendix III. This classification is broader compared to that in Chapter 2 as it includes a wider variety of KIBS such as financial sector, legal, accounting, property development and creative industries.

Table 3.1 Broad KIBS categories by SIC

SIC categories included in analysis of KIBS location in the UK from 2000-2008
1. The wholesale financial services
65. Financial intermediation
6601 Life insurance
6603 Non-life insurance
67 Auxiliary financial intermediation
2. R&D
73 Research and Development
3. Computer and Related Activities
7219 Hardware consultancy
7220 Software consultancy and supply
7230 Data processing
7240 Database activity
4. Knowledge intensive "other business activities", excluding functions such as catering, security, cleaning, packaging, secretarial agencies and labour recruitment.
7411 Legal activities
7412 Accountancy/book-keeping etc.
7413 Market research/public opinion polling
7414 Business/management consulting
7415 Management activities, holding companies
7420 Architectural/Engineering
7430 Technical testing and analysis
5. Business oriented property development and management (excluding estate agencies)
7011 Development and selling real estate
7032 Management of real estate
6. Creative sectors
221 Publishing
744 Advertising
7481 Photographic activities
9211 Motion picture and video production
9220 Radio and TV activities
9231 Artistic and literary creation etc.
9232 Operation of arts facilities

Source: Modified from Wood (2006)

3.2 KIBS and uneven development

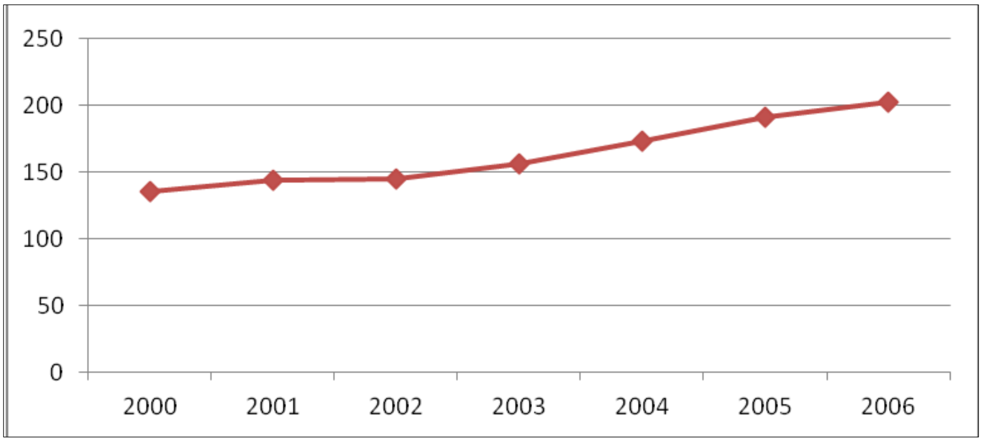
One characteristic of the pre-recession period was a trend towards non- financial KIBS employment growth in central London (Wood and Wojcik, 2010). Research in the UK (Daniels, 1985; Marshal and Wood, 1995) and other countries such as Canada (Coffey, 1994; 1996; Coffey and Shearmur, 1997; Shearmur and Doloreux, 2012) and the US (Beyers, 1989) has shown spatial concentration of KIBS at the level of large metropolitan areas. The empirical regional agglomeration literature specifically focused on KIBS is not very large. However, some optimism has been expressed in policy circles concerning the potential of KIBS to aid to the solution of the economic development outside non-metropolitan regions (Coffey and Shearmur, 1997, 405). While Polese and Shearmur (2006) find that some KIBS followed their manufacturing clients outside the central urban areas, Shearmur and Doloreux (2008) argue that KIBS location in large urban areas may serve their manufacturing clients at the distance and they may not chose to leave their metropolitan location.

Wernerheim and Sharpe (2003) show that in the absence of the supporting manufacturing sector or close proximity to customers, government policies aimed at attracting KIBS to more peripheral locations are not likely to succeed. The general conclusion which stems from subsequent empirical analysis of KIBS location patterns in various countries is that there is very little cause for optimism concerning the capacity of KIBS to stimulate economic development in non-metropolitan regions. Hence, the emphasis on services in regional policy to date remains largely tentative. In the following section, the uneven spatial distribution of KIBS within the UK regional and sub-regional level will be examined as well as some analysis of KIBS sub-sectors.

3.2.1 KIBS GVA- growing trend

KIBS have grown significantly in the UK in the past decades. In the past two decades they have increased their share of GDP from 4 to 14 per cent and created almost 1.7 million jobs. KIBS now provide more employee jobs than manufacturing (DTI, 2007). The growth of KIBS (measured as gross value at basic prices, GVA) is presented in Figure 3.1. There has been approximately 50 percentage change growth in the KIBS GVA from 2000 to 2006 amounting to some £200 billion GVA in 2006.

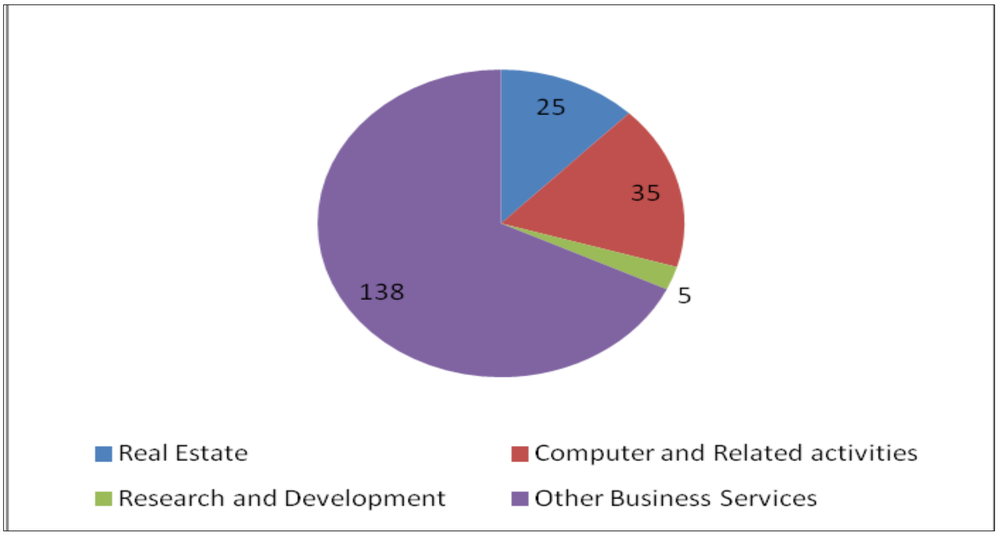
Figure 3.1UK KIBS GVA at basic prices



Source: ONS; Annual Business Inquiry (ABI) online database (excludes financial services and creative industries)

In terms of UK GVA, Other Business Services make up the major bulk of the UK GVA (138 billion) with a relatively small R&D sector (5 billion) (Figure 3.2).

Figure 3.2 UK GVA by KIBS sub-sectors



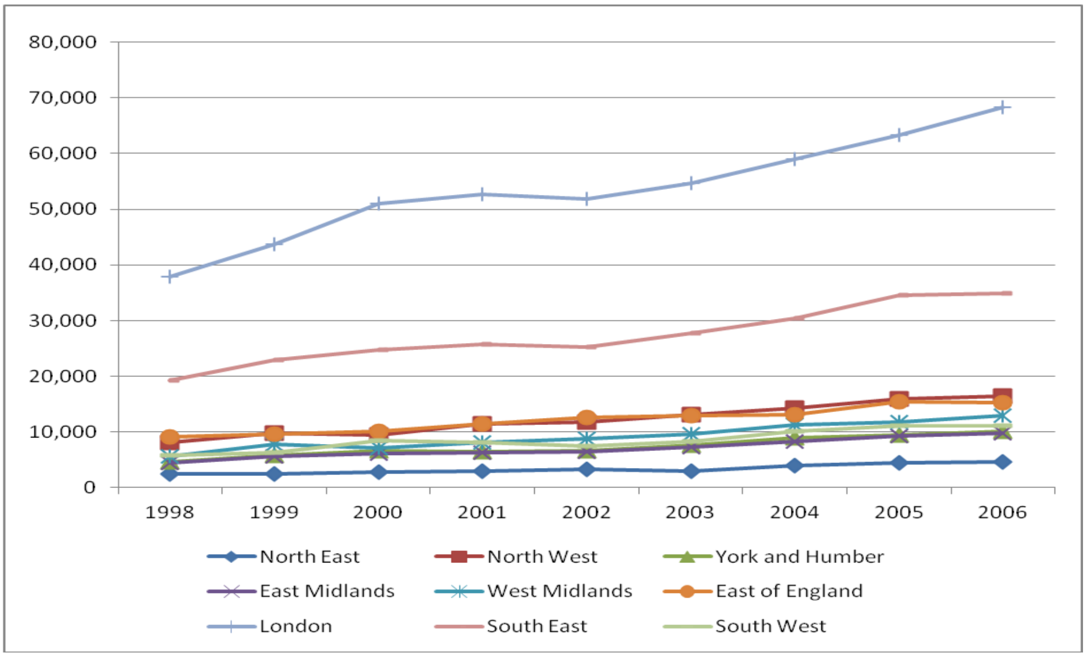
Source: ONS; ABI online database (excludes financial services and creative industries)

UK does particularly well in trade in business services. Business services contributed £18 billion in surplus to the UK trade balance in 2005, a threefold increase compared to the previous ten years. UK trade exports in "Other Commercial Services"[1] with the rest of the world has increased from 79,875 billion in 2001 to 121,495 billion in 2004 (OECD Statistics on

International Trade in Services, Online Database). There are a number of factors that can explain the success of the UK's KIBS such as high workforce skills and ability to better promote themselves internationally (DTI, 2007).

Regional analysis of GVA in KIBS (Figure 3.3) shows that London and the South East are the greatest contributors to the UK economy. Other regions lag behind.

Figure 3.3 UK KIBS GVA at basic prices Government Office Regions



Source: ONS, ABI online database (excludes financial services and creative industries)

3.3.2 Entrepreneurship in KIBS

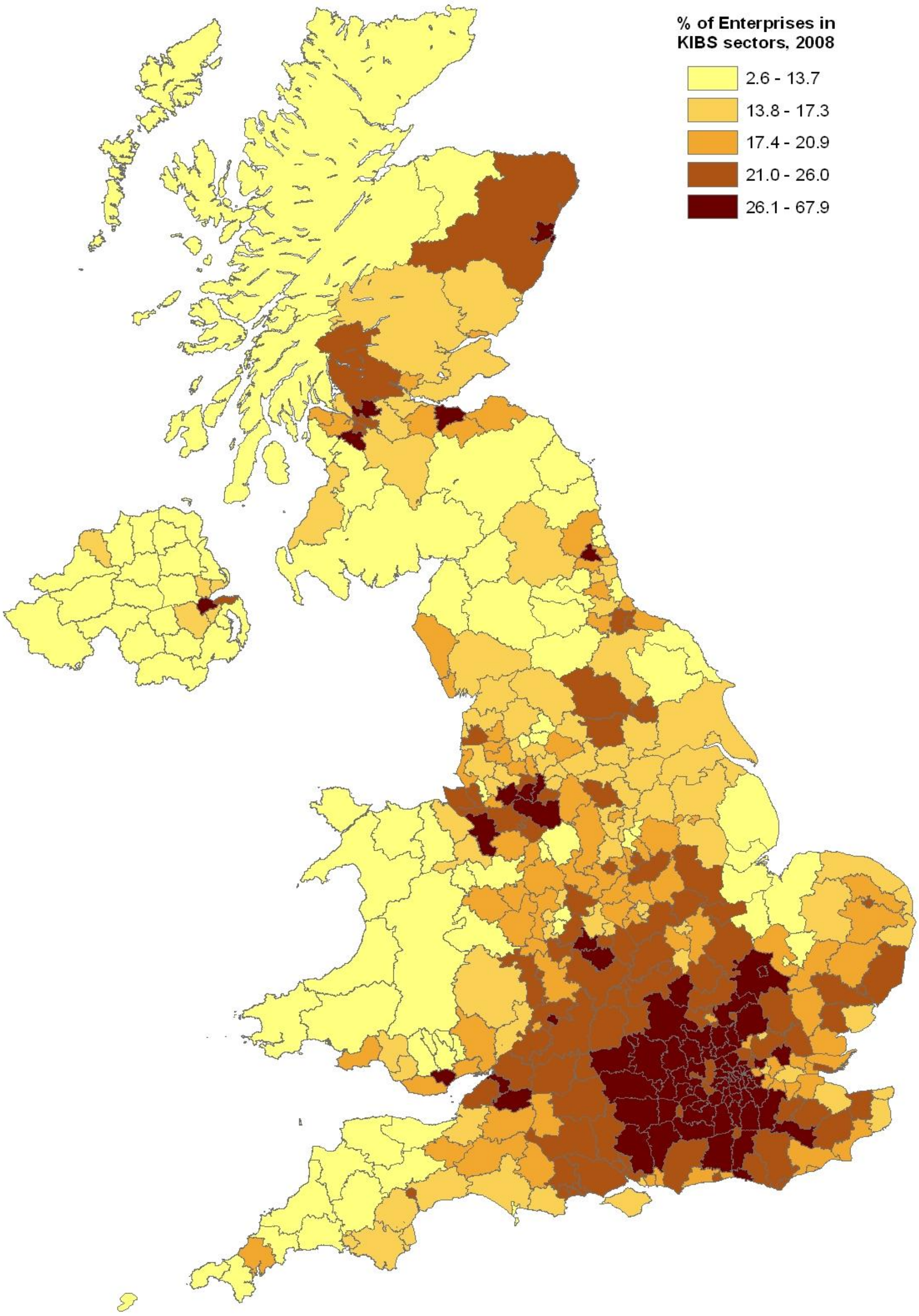
Most studies on the geography of KIBS location concentrate on employment in KIBS rather than location and creation of KIBS enterprises. It is important to make the distinction between the two as some significant changes in KIBS employment reflect strategic decisions of large corporations to change locations of their headquarters or simply decisions to set up back offices in particular places. This is widely observed in the Financial Sector. This thesis is concerned with KIBS SMEs since the majority of the sector is comprised of the small and medium enterprises. This research also aims to capture entrepreneurial and innovation activities of KIBS SMEs in the UK rather than strategic decisions of large companies. Even though large corporations are important, creation of new ventures and organisations (in other words entrepreneurship) is believed to be an engine of growth in the economy.

Below maps show concentration of enterprises in KIBS sub-sectors as a proportion of all area enterprises. Classification scheme for the maps is based on quintiles. It is evident that the sector is concentrated in and around London and surrounding areas of the Greater South East including London, the South East, the East and some parts of the South West former Government Office Regions (GORs). Somewhat greater dispersion can be noted amongst Financial Services (Figure 3.5), R&D (Figure 3.6), whereas higher concentration is noted in Computer and Related industries (Figure 3.7).

It is evident that the influence of regional demand is reflected in the variation of KIBS in these areas. The financial services are most characteristic of Central London, the core cities in both North and South and larger freestanding southern cities and towns (Figure 3.5). These financial services serve international, national and regional commercial demand. Computer and Related services are concentrated in the South, especially in outer London and the core city hinterlands, also extending to rural counties. From there they serve corporate headquarters, manufacturing and other private and public services and R&D whereas at the same time in some cases choosing locations from which they exploit access to international airports enabling them to reach international clients

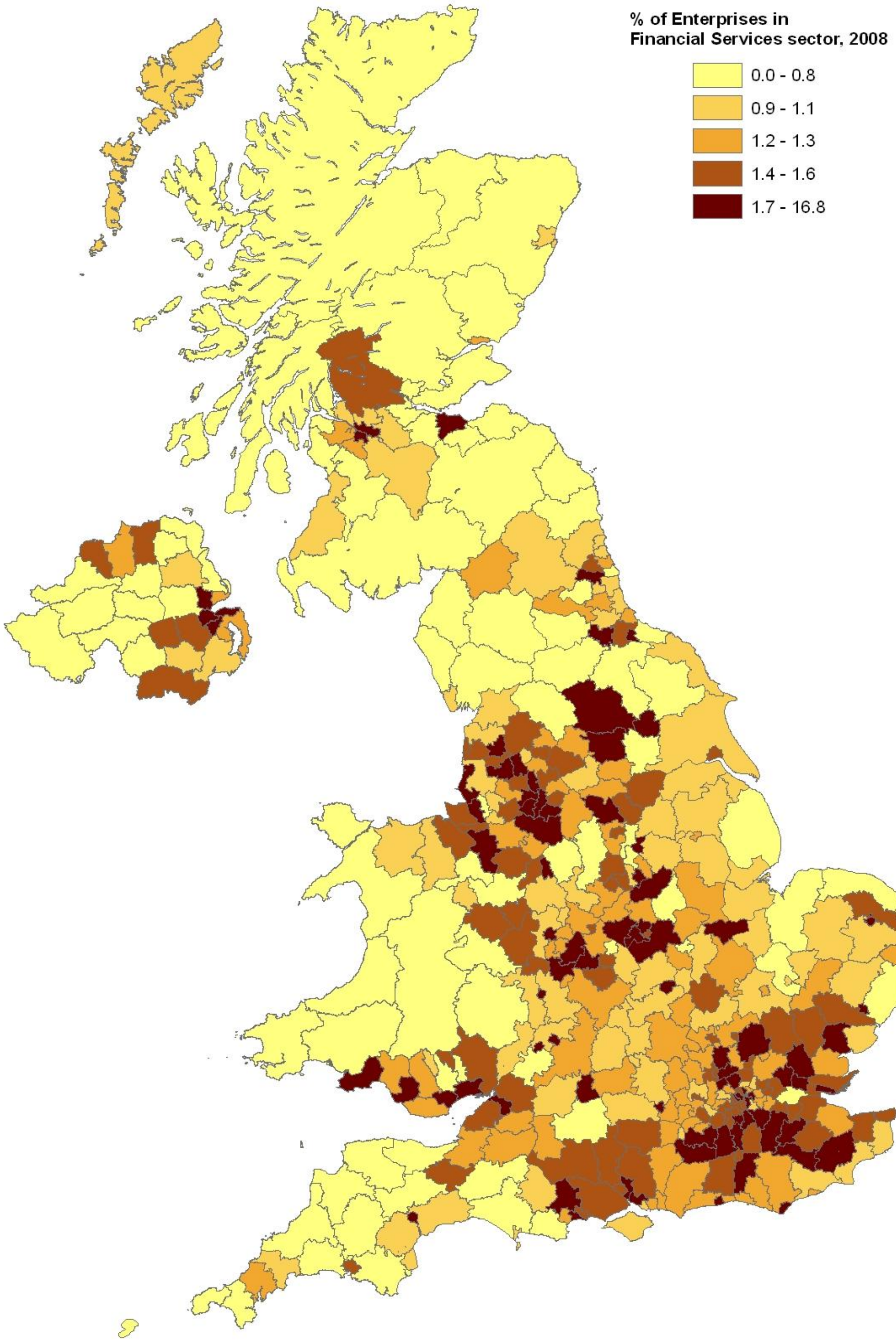
(Figure 3.7). R&D firms are concentrated in industrial hinterlands of the core cities and to a lesser extent in smaller towns and rural areas, sometimes close to oil extraction industry (Figure 3.6).

Figure 3.4



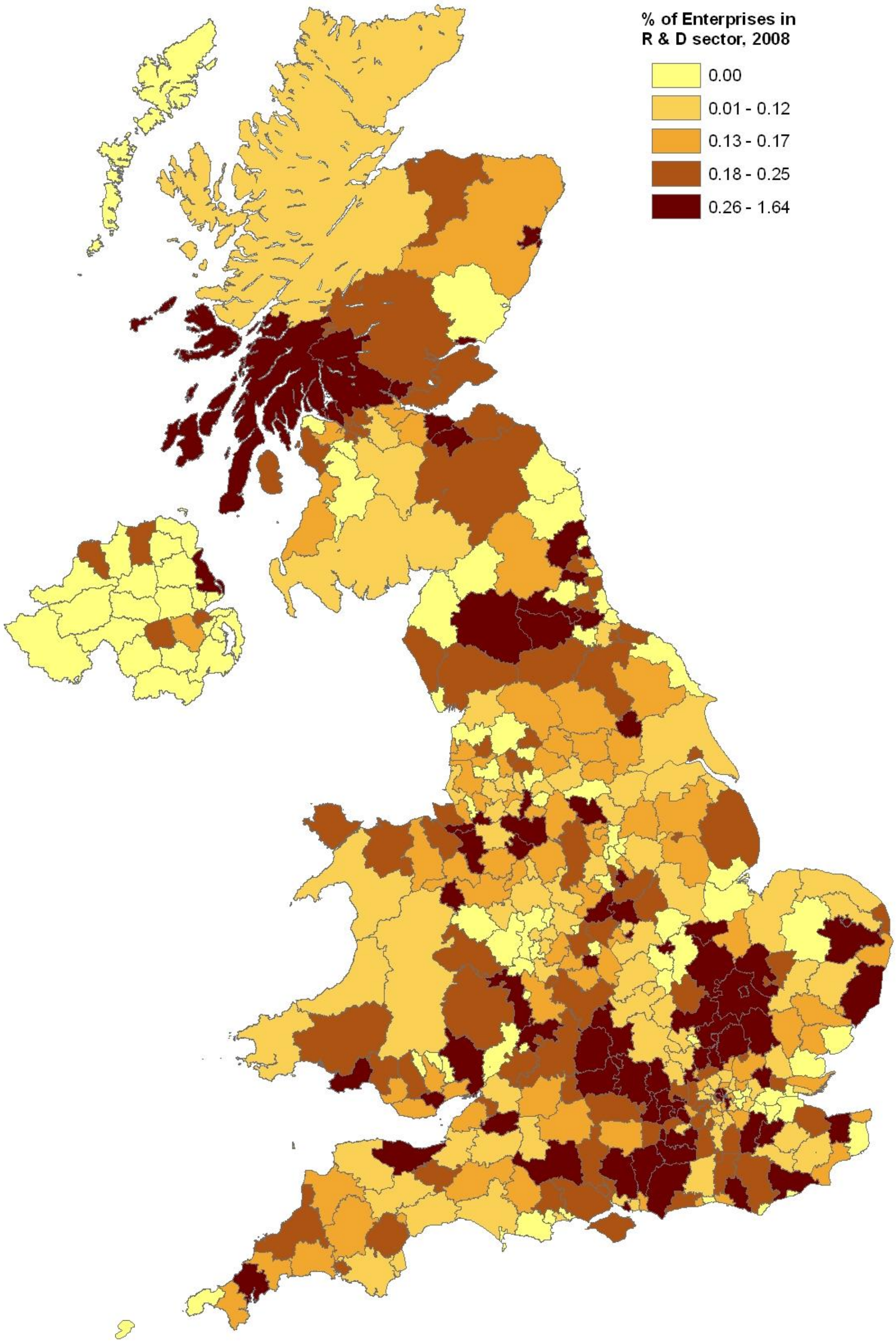
Source:IDBR, ONS

Figure 3.5



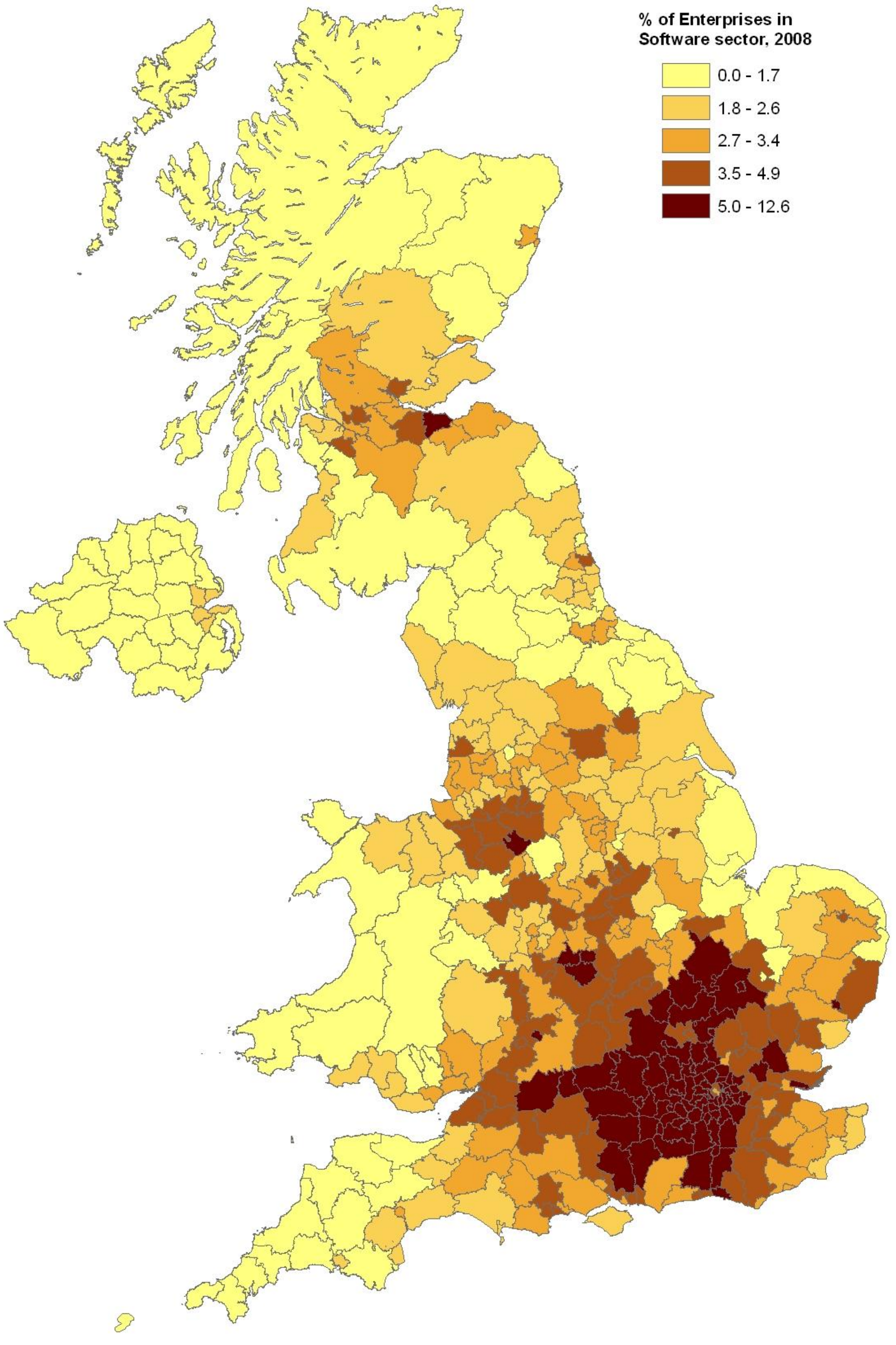
Source: IDBR, ONS

Figure 3.6



Source: IDBR, ONS

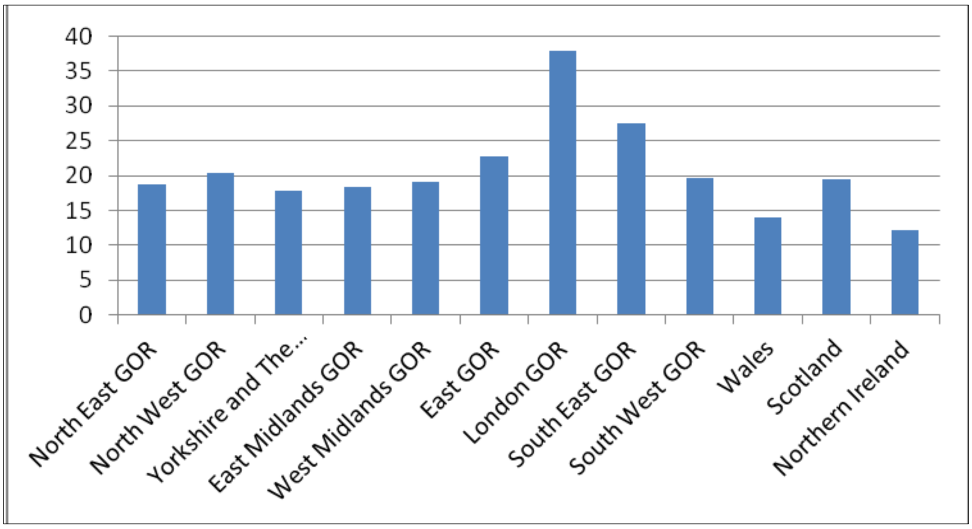
Figure 3.7



Source: IDBR, ONS

An absolute number of KIBS companies in the UK (data relating to March 2008) was 504,225 (all data rounded to the nearest five). This represents an absolute increase of 113,630 companies, a 29 percentage increase from 2000. KIBS constitute a 23% of all UK companies, a 3% increase from 2000. Figure 3.8 shows that the greatest share of KIBS companies compared to other sectors is in London, the South East and the East GORs, with London leading the way with 38% of total KIBS.

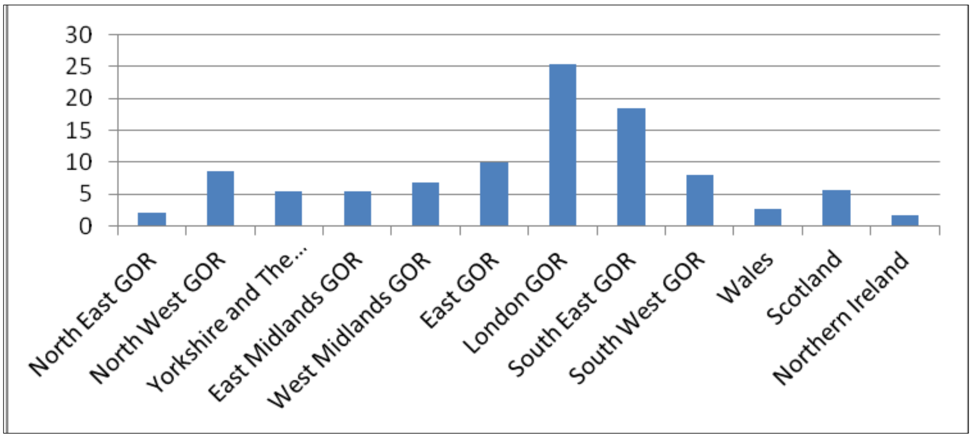
Figure 3.8 KIBS as a proportion of all regional companies



Source: IDBR, ONS

Figure 3.9 shows that the greatest share of national KIBS concentration is based in London and the South East with 25% and 19% respectively. Since 44% of KIBS companies locate in only two UK regions an interesting question is what makes these locations attractive for KIBS? It has been agrued that KIBS activites locate in metropolitan areas from where they benefit from local demand and supply of skiled labour. London is an exceptional case as KIBS located in London serve not only local but also largely international clients. Closer sub-regional analysis of the UK Counties reveals that the highest numbers of KIBS locate in Surrey (near London). This provides some support to enterprising behaviour theory (Keeble and Nachum, 2002) which argues that decentralisation, in the form of creation and growth of new firms in rural areas and small towns can be explained at least in part by continually raising household incomes and mobility. These have in turn enabled increasing numbers of highly-qualified professionals and managers and their famillies to migrate from congested metropolitan cities to environmentally-atractive rural areas and small towns for reasons of residential amenity and enhanced quality of life (Keeble and Nachum, 2002). These migrants bring with them know-how, expertise and client networks derived from their previous big city employment which enable entrepreneurship and new firm creation in their chosen small town and rural location (Keeble, 1997). Surrey with its attractiveness, good local amenities and connectedness to London serves as a good example of one such attractive location.

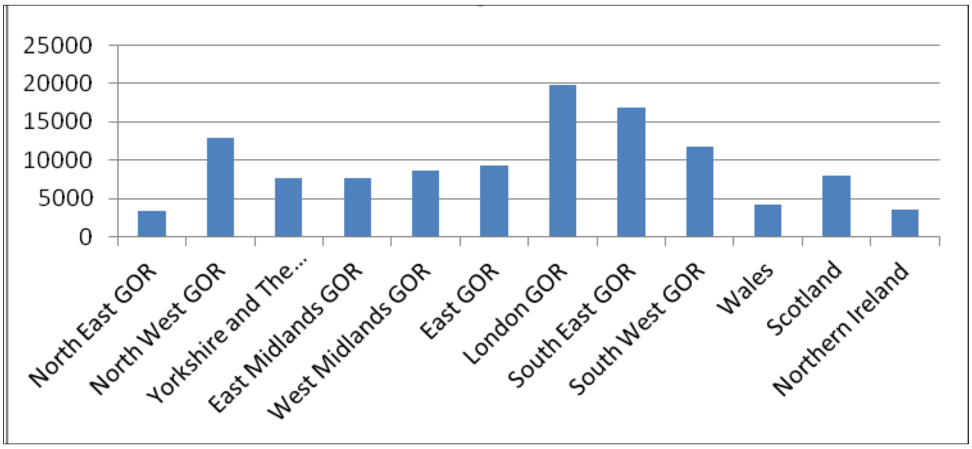
Figure 3.9 KIBS companies as a percentage of total UK KIBS



Source: IDBR, ONS

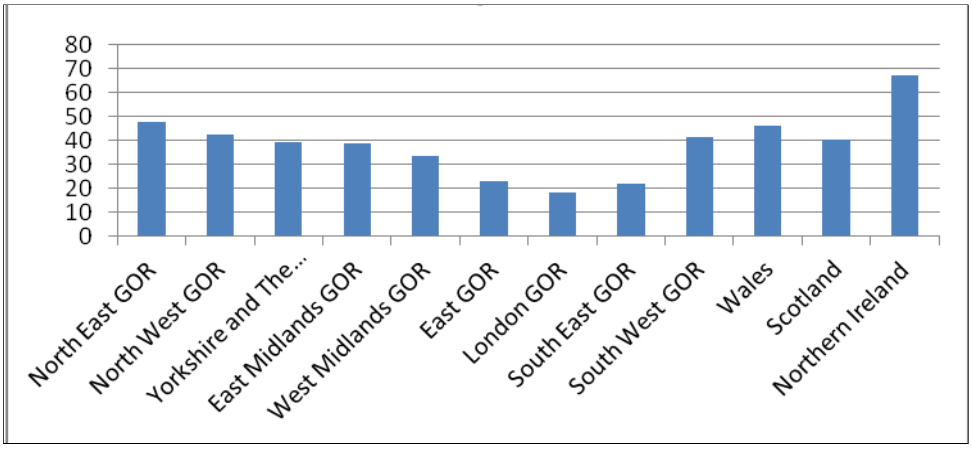
Figures 3.10 and 3.11 represent changes in the enterpreneurial activity in KIBS. It is important to note that London exibits the lowest percentage increase in the numbers of KIBS, only 18% compared to 67% in Northern Ireland. In absolute terms however, London (an increase of some 20,000 companies) and the South East still lead the way and the North West and the South West exibit substantial increases in numbers of KIBS entreprises too.

Figure 3.10 Absolute change in numbers of KIBS 2000/2008



Source: IDBR, ONS

Figure 3.11 Percentage change in numbers of KIBS

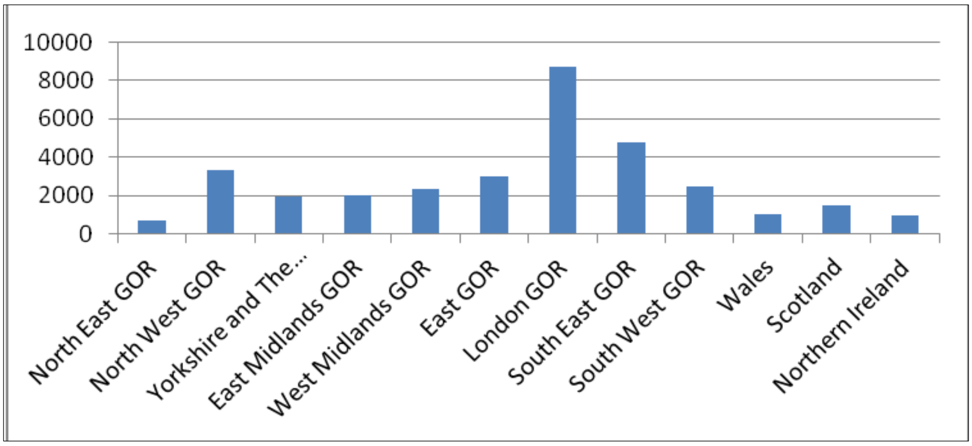


Source: IDBR, ONS

Figures 3.12 to 3.17 show location of KIBS enterprises by sector in the UK Government Office Regions. They generally illustrate that London leads the way in relation to highest concentration of most sub-sectors apart from R&D. R&D exhibits highest concentration in the South East GOR. The difference is most pronounced with regards to Financial Services which mostly locate in London. Distribution is slightly more even in the Other KIBS and Property Development and Management.

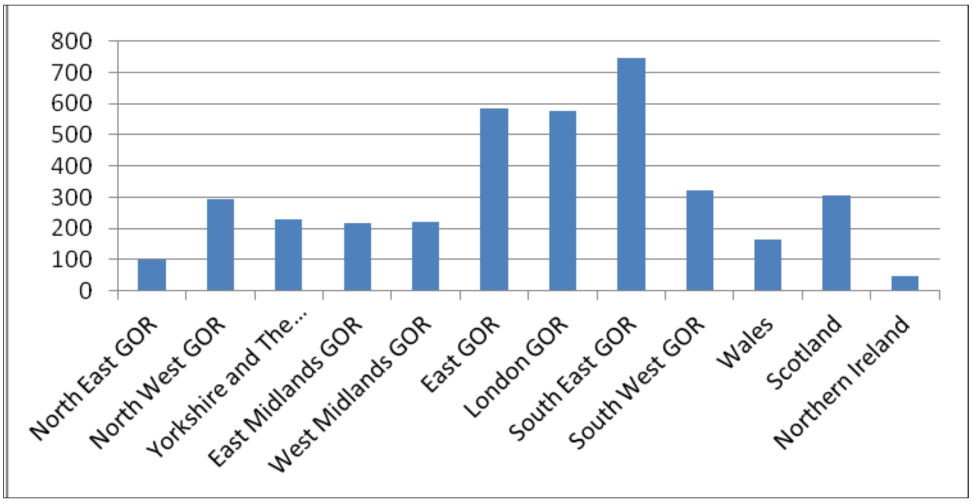
With reference to the UK economy and London specifically the nature and special dynamics of the financial sector (“the power of money”) as argued by Marshall and Wood (1995) drive supply and demand for other KIBS. “The globalisation of financial markets which has been encouraged by the weakening of the national regulations resulted in innovation of financial products and produced rapid growth in international finance during the 1980s which particularly in the US and UK spilled over into demand for domestic financial services and related consultancy, legal and real estate service" (Marshall and Wood 1995). However, (Wood and Wojcek, 2010) emphasise that other KIBS in London and the South East thrive on the demand from other sectors (not only financial) and have developed their expertise in relation to UK wide and international clientele.

Figure 3.12 Financial services absolute numbers of companies



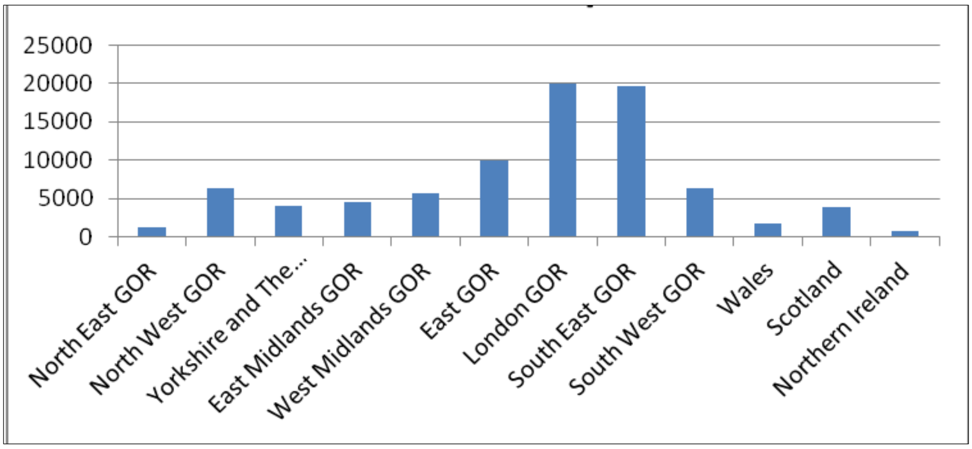
Source: IDBR, ONS

Figure 3.13 R&D absolute numbers of companies



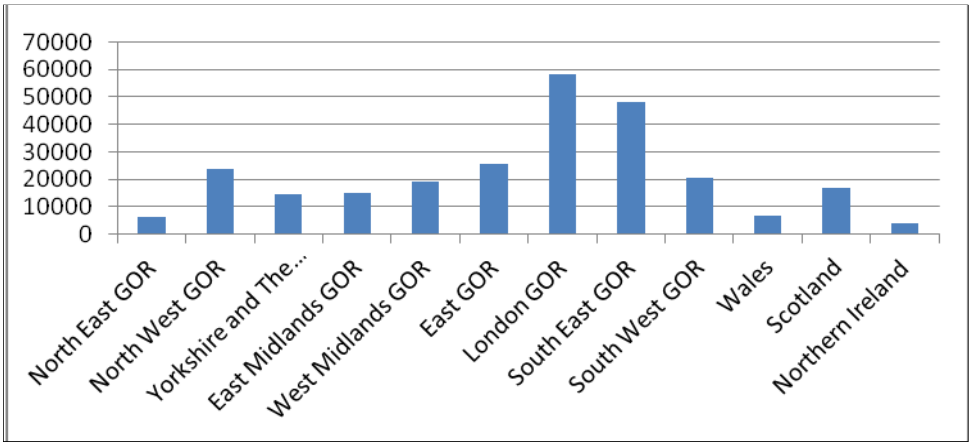
Source: IDBR, ONS

Figure 3.14 Computer and related absolute numbers of companies



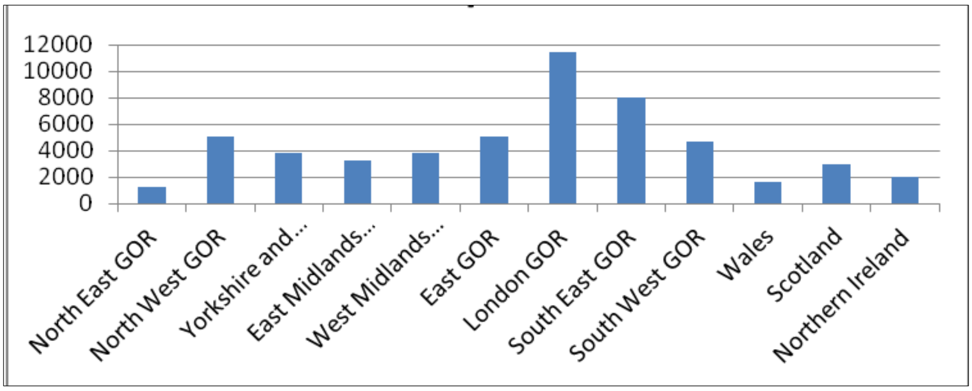
Source: IDBR, ONS

Figure 3.15 Other KIBS absolute numbers of companies



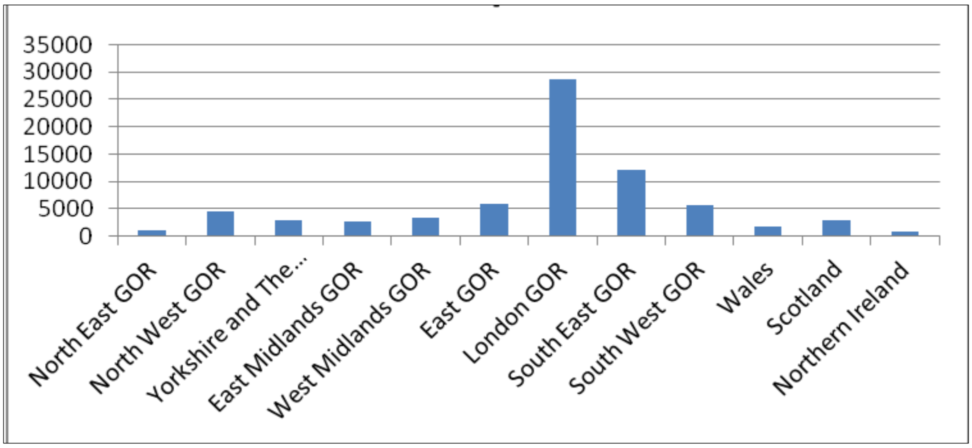
Source: IDBR, ONS

Figure 3.16 Property development and management absolute numbers of companies



Source: IDBR, ONS

Figure 3.17 Creative industries absolute numbers of companies



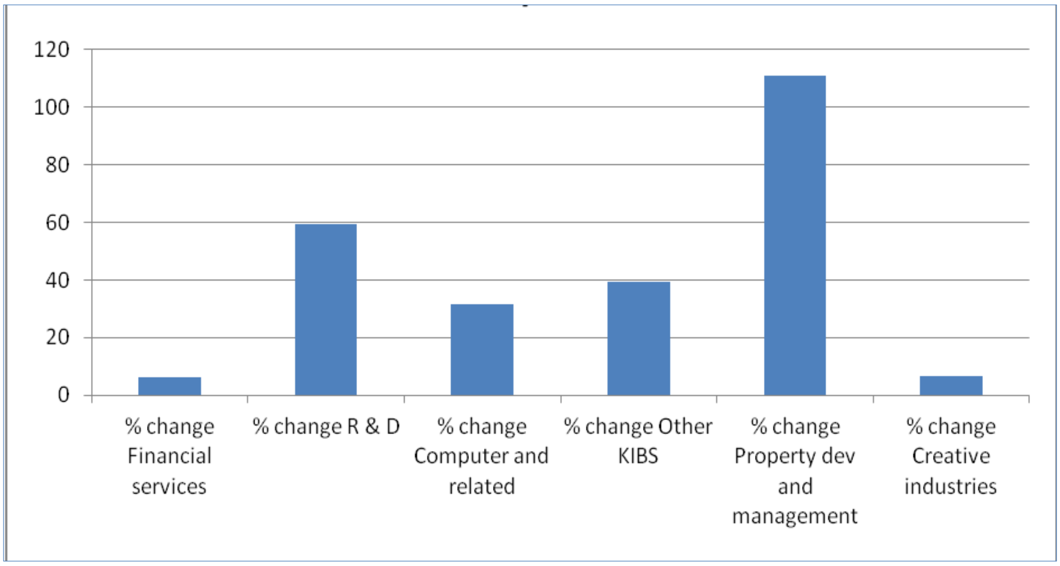
Source: IDBR, ONS

3.3.4 Employment in KIBS

In the UK, employment in KIBS represents 13% of total employment (as per March, 2008). This is higher than the EU25 average of 8%. In overall terms UK is the biggest employer, accounting for almost 4 million employees in 2008 an increase of 758,833 employees since 2000.

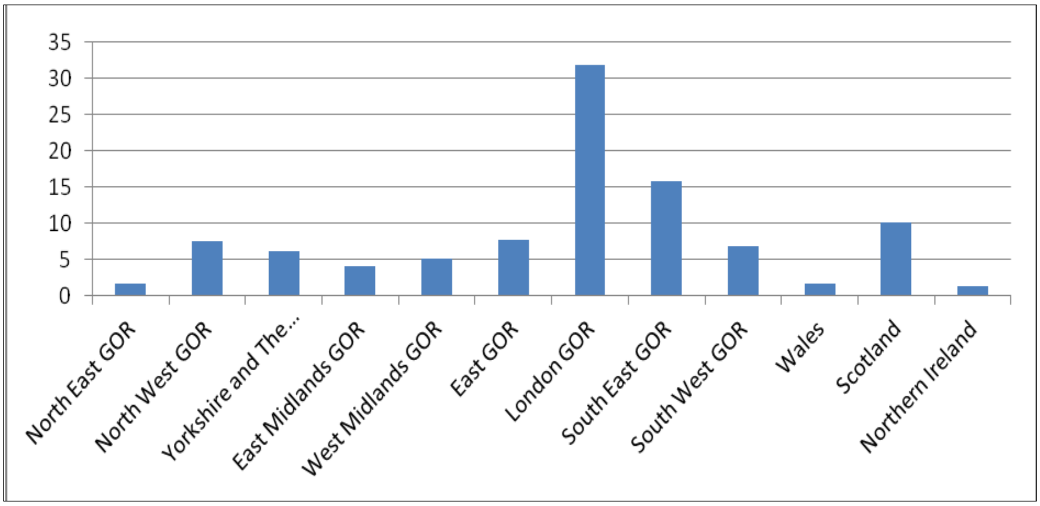
Regarding KIBS subsectors, the highest employment growth is noted in the Property Development and Management sub-sector (111%) followed by R&D (with 60% increase from 2000 to 2008) (Figure 3.18). The increase in the property market employment can be explained as a result of the UK property market boom.

Figure 3.18 UK employment in KIBS percentage change 2000/2008



Source: IDBR, ONS

Figure 3.19 Area employment in KIBS as a percentage of national employment in KIBS (2008)



Source: IDBR, ONS

Figure 3.19 shows the concentration of KIBS employment in London (32%) and South East (16%) with Scotland also exhibiting relatively high share of 10%. Data presented in Figure 3.19 clearly demonstrates the gap between London and other regions. It seems that not much has changed for London since eighties as Gillespie and Green (1987) showed that in

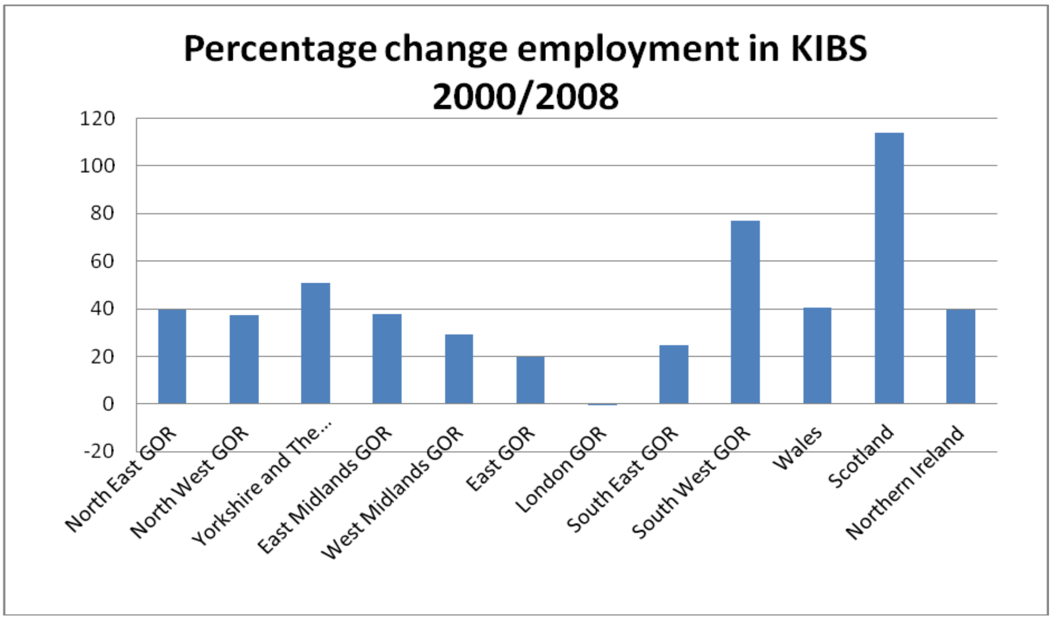
1981 London had 621,000 of KIBS jobs, representing 34% of the national total. Together London and the South East amount to almost 50% of KIBS national employment.

It is important to note that all regions (with a notable exception of London which exhibits a decrease of 1%) marked an increase in KIBS employment (Figure 3.20). It does not seem feasible to conclude from this analysis that London may lose its supremacy over other regions in terms of employment in KIBS since other regions start from a much lower absolute base. However, it seems that the period of cyclical downturn from 2000-2003 especially negatively affected London's financial and business services (Wood, 2006). 2000-2003 marks a period of the international recession and subsequent recovery by 2006 (Wood and Wojcek, 2010). This period can be characterised by changing geography of financial services whereby City of London lost financial jobs and Canary Warf gained employment in financial sector (Wood and Wojcek, 2010).

IDBR data shows a 46% loss of jobs or 184,697 jobs in the financial industry in the City of London during the period 2000 to 2008. There was some, albeit modest positive change in employment in the financial industry between 2000 and 2008 whereby Canary Warf (London Borough of Tower Hamlets) gained 31,104 jobs in financial services (from a base of 22, 474 jobs in 2000). However, it seems that this initial recovery of financial jobs led by Canary Warf has been offset by much larger losses of financial jobs in the City of London which continued after 2006.

The total loss of financial jobs in the London GOR was 169,739 or 30%. Expansion of the financial sector in 2000-2008 was concentrated in Scotland and the South West. However, as noted above this information should be interpreted with great caution as it is possible that some of these job losses in the financial industry in the City of London may have actually occurred in other regions. When banks' headquarters report employment figures these relate to all branches and not just the headquarters hence it is impossible to establish which regions have been actually more affected.

Figure 3.20 Percentage change employment in KIBS 2000/2008



Source: IDBR, ONS

UK marked a growth in employment (2000-2008) in all sub categories of KIBS. This increase in employeemnt relates to : Financial- 6&, R&D- 60%, Software- 32%, Other KIBS- 40%, Property Develpment and Management- 111% and Creative industries- 7% (Figure 3.21). It is worth noting from Figure 3.21 a significant gain in employment in Financial Services in the the South West and Scotland. This trend can be partly explained by reallocation decisions of large financial corporations in pursuit of cheaper locations outside London. The North West and the North East gained highest increase in R&D. In Computer and related activities the highest employment increase was in the North West and Northern Ireland. Other KIBS employment growth was more evenly spread. The East Midlands and the East GOR marked highest increase in Creative industries employment compared to other regions whereas the highest decrease in creative jobs is noted in the West Midlands and the North East.

Figure 3.21 Percentage change employment in KIBS by sub-sector and region

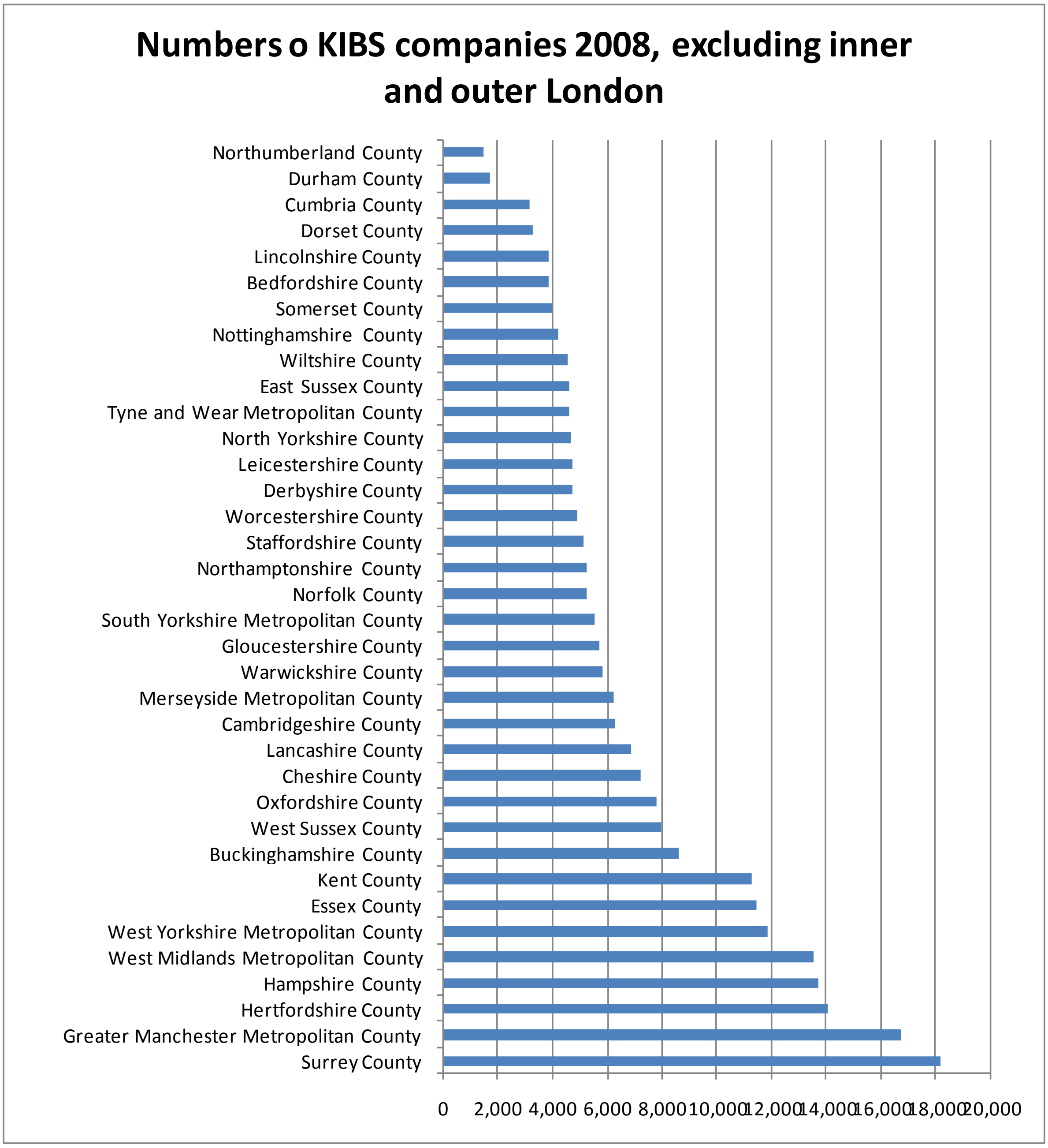
2000/2008	Financial services	R & D	Computer and related	Other KIBS	Property dev and management	Creative industries
Government Office Region	% change	% change	% change	% change	% change	% change
North East GOR	127	198	34	25	234	-25
North West GOR	-16	421	137	46	164	-11
Yorkshire and The Humber GOR	56	82	46	46	220	0
East Midlands GOR	77	53	29	14	115	38
West Midlands GOR	-5	-42	43	51	113	-20
East GOR	-19	66	7	32	146	32
London GOR	-30	11	20	36	54	9
South East GOR	-27	62	25	45	104	9
South West GOR	263	52	24	50	65	-16
Wales	52	14	44	46	94	-9
Scotland	217	37	77	41	266	19
Northern Ireland	28	82	141	33	143	-10
UK	**6**	**60**	**32**	**40**	**111**	**7**
Source: ONS IDBR						

Source: IDBR, ONS

3.3.5 Sub-regional analysis by county

Analysis of numbers of KIBS companies by county (Figure 3.22), shows that apart from large metropolitan counties of Greater Manchester (with a total of 16,690 KIBS establishments in 2008), the West Midlands (which includes Birmingham) (with a total of 13,510 KIBS establishments in 2008), and the West Yorkshire (which includes Leeds) (with a total of 11,815 KIBS establishments in 2008), concentration of KIBS is noted in Surrey (with a total of 18,145 KIBS establishments in 2008), Hertfordshire (with a total of 14,005 KIBS establishments in 2008), Hampshire (with a total of 13,700 KIBS establishments in 2008), Essex (with a total of 11,420 KIBS establishments in 2008) and Kent (with a total of 11,250 KIBS establishments in 2008). These counties locate within the Greater South East, not far rom London and benefit from good physical access to customers, transport facilities including international airports, high quality communications infrastructure, quality labour, attractive office sites and other facilities.

Figure 3.22 Numbers of KIBS companies by county (exludes inner and outer London)



Source:IDBR, ONS

3.3.6 Sub regional analysis by Core Cities

Since 2000 the UK government in cooperation with the city authorities started to focus more on the promotion of “core cities” with the aim to support both national and regional economic development goals (ODPM, 2004). The English “core cities” group as defined by former Office of the Deputy Prime Minister (ODPM) consists of Manchester, Birmingham, Leeds, Liverpool, Sheffield, Newcastle, Nottingham and Bristol. The initiative came about due to concerns associated with the implications of the geography of innovation which are most clearly indicated in London's experience (Wood, 2008). It has been argued that capital's growing national economic domination, with the surrounding South East region happens at the detriment of other core cities (Wood, 2008). Proceeding analysis concentrates on "core cities".

As per Figure 3.23 among the "core cities" inner London, Bristol, Sheffield and Liverpool economies are dominated by KIBS and have a share of KIBS employment higher than the national average while Newcastle, Birmingham and Leeds economies are least dominated by the sector.

Figure 3.23. Core cities KIBS employment by sub-sectors

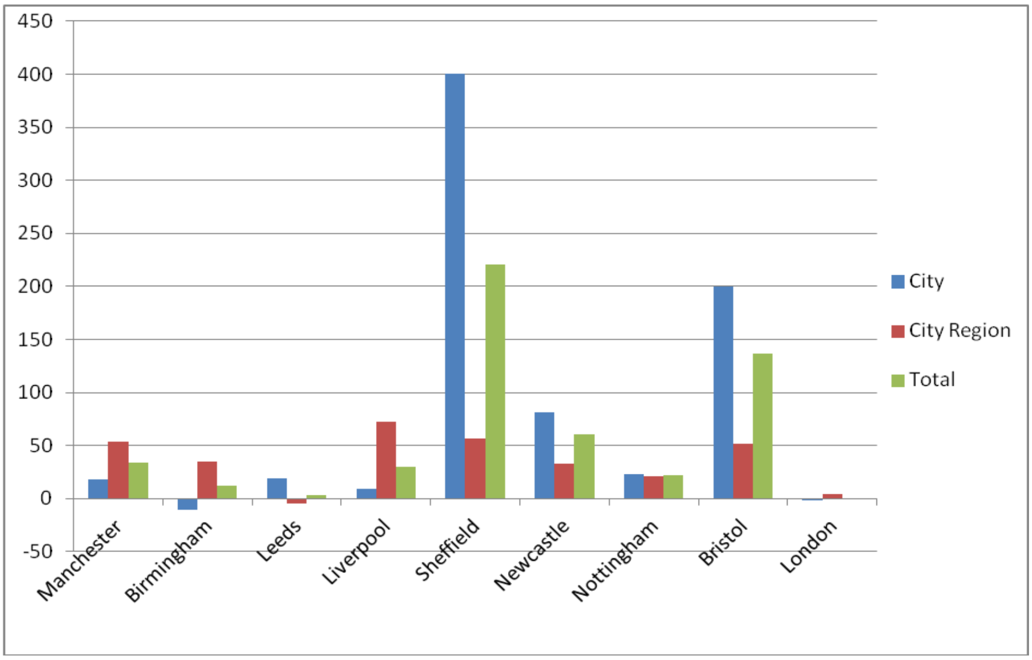
% of area employment	Financial Services	R & D	Computer and related	Other KIBS	Property Development & Mgt	Creative Industries	Total KIBS	Other
Manchester	2.1	0.2	0.5	6.0	1.1	1.9	12.1	87.9
Birmingham	1.6	0.0	0.7	3.4	0.8	0.6	7.2	92.8
Leeds	2.2	0.1	0.6	4.1	0.7	0.6	8.2	91.8
Liverpool	6.4	0.0	0.5	7.1	0.6	0.8	15.4	84.6
Sheffield	*	*	1.2	4.9	0.9	0.6	28.8	71.2
Newcastle	2.2	0.1	1.0	3.1	0.6	0.5	7.6	92.4
Nottingham	2.5	0.1	2.4	2.8	0.7	0.9	9.2	90.8
Bristol	*	0.1	*	5.3	0.5	1.1	30.8	69.2
Inner London	**11.6**	0.5	1.8	10.4	1.2	5.3	30.8	69.2

* disclosive data/not available;
Source: IDBR, ONS

UK average percentage increase in KIBS employment was 26% from 2000 to 2008. Figure 3.24 shows that the highest percentage increase in KIBS employment amongst "core cities" can be seen in Sheffield and Bristol (400% and 200% respectively). It should be noted that employment figures in these two core cities start from a relatively low base (KIBS employment in 2000 in Sheffield was 13,728 raising to 68,747 in 2008 whereas in Bristol employment in KIBS in 2000 was 26,210 raising to 78,616 in 2008). Only Sheffield, Newcastle and Bristol exhibit higher than national average percentage increase in KIBS employment. KIBS growth therefore lagged behind the national average in most core cities while the city of Birmingham, Inner London and Leeds region marked a decrease in KIBS employment.

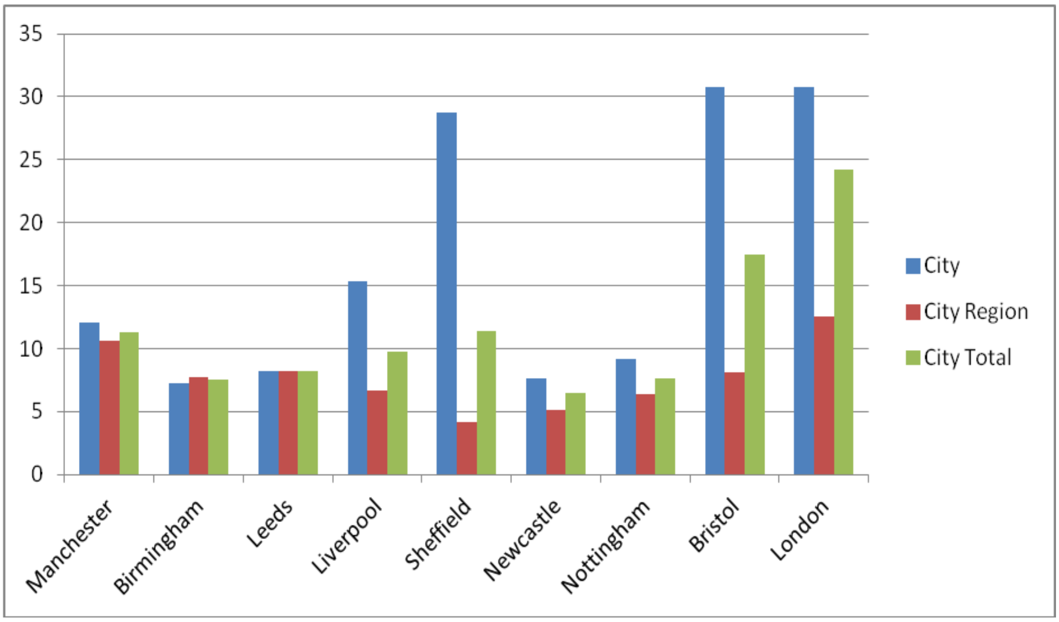
The decrease in Leeds region can be partially explained by the merger of Halifax building society and the Bank of Scotland which in 2001 resulted in a decision to move Halifax headquarters from Calderdale to Edinburgh. However, Leeds is still home to some of the UK leading names in banking and insurance such as First Direct, GE Capital, Alliance and Leicester, Halifax Direct and Direct Line. Liverpool city region's1 gain in KIBS employment is partly explained by an increase of finance jobs in Sefton. This clearly shows that the bulk of change in KIBS employment happens as a result of large financial companies' decisions to move their headquarters from location to location and these changes seem to have profound effects on the employment in KIBS. Entrepreneurial activities of KIBS related to formation and proliferation of KIBS small and medium enterprises represents a different trend which requires separate analysis.

Figure 3.24 Percentage change employment in KIBS/ core cities and city regions



Source: IDBR, ONS

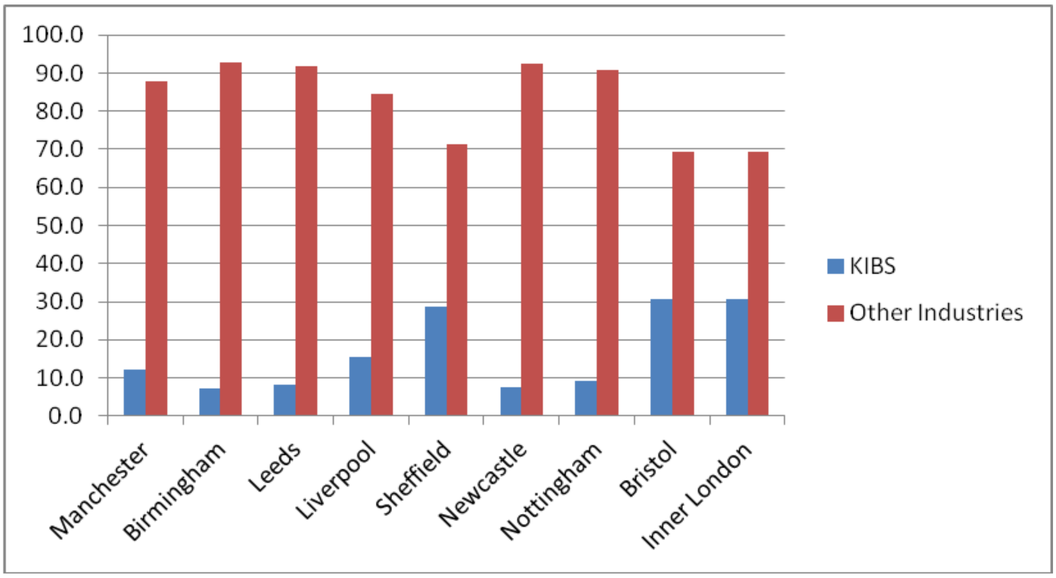
Figure 3.25 Employment in KIBS as a proportion of area employment/ core cities



Source: IDBR, ONS

It can be concluded from figure 3.26 that Birmingham, Leeds, Newcastle and Nottingham have the lowest concentration of KIBS in comparison to the concentration of other industries in these cities, whereas Sheffield, Bristol and London have the highest. KIBS are most important, relative to other industries, in Liverpool, Sheffield, Bristol and Inner London where they exibit higher than the national employment concentration (greater than 13%).

Figure 3.26 KIBS and other industries as a proportion of area employment



Source: IDBR, ONS

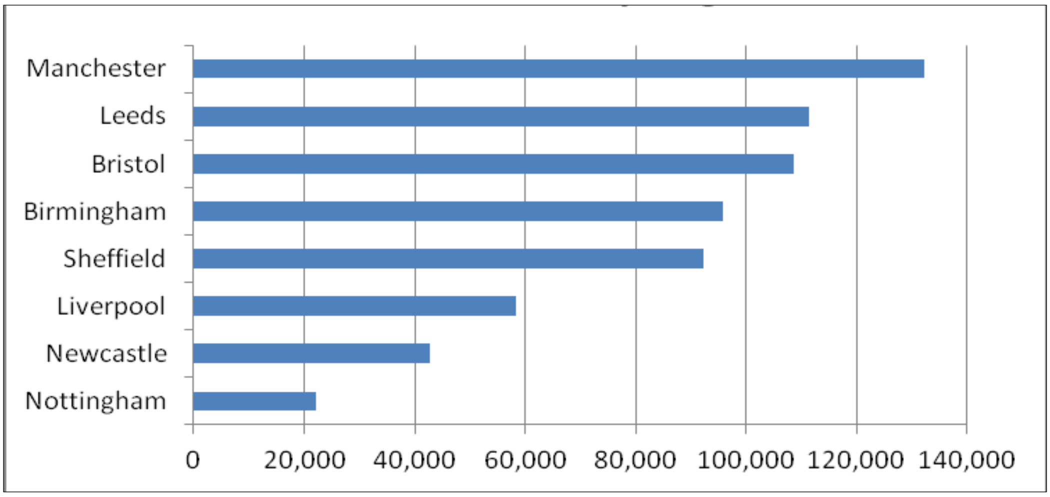
Figure 3.27 shows the breakdown of percentage change in employment in KIBS sub-sectors from 2000 to 2008. Employment growth in the Property Development and Management in all cities except Bristol is remarkable. Also, all cities (except Nottingham and London) exibit the reduction in employment in Creative Industries. Newcastle, Manchester and Bristol benefited from a high employment growth in R&D while all cities saw an incease in R&D employment (except Leeds). The increase in R&D can be partially explained by recent government "science cities" initiative which aims to promote UK cities as world wide centres of excellence in science and related industries. Leeds did not participate in this initiative. Further analysis shows that London has lost 30 percent of its finance jobs while Nottingham has gained 338 per cent (but from a low initial base).

Figure 3.27 Percentage change employment in KIBS 2000-2008

% change employment in KIBS	**Financial services % change**	**R & D % change**	**Software % change**	**Other KIBS % change**	**Property dev and management % change**	**Creative industries % change**
Manchester	-38	365	-25	70	347	-8
Birmingham	-32	2	-21	7	99	-47
Leeds	4	-43	13	43	190	-41
Liverpool	-18	*	-43	77	*	-28
Sheffield	*	*	91	42	398	-34
Newcastle	49	300	-17	-39	78	-67
Nottingham	338	10	40	-39	388	59
Bristol	*	351	*	61	-44	-47
Inner London	-30	56	42	40	47	10

*discolosive data/not available
Source: IDBR, ONS

Figure 3.28 Employment in KIBS by core cities and city regions (2008)



Source: IDBR, ONS

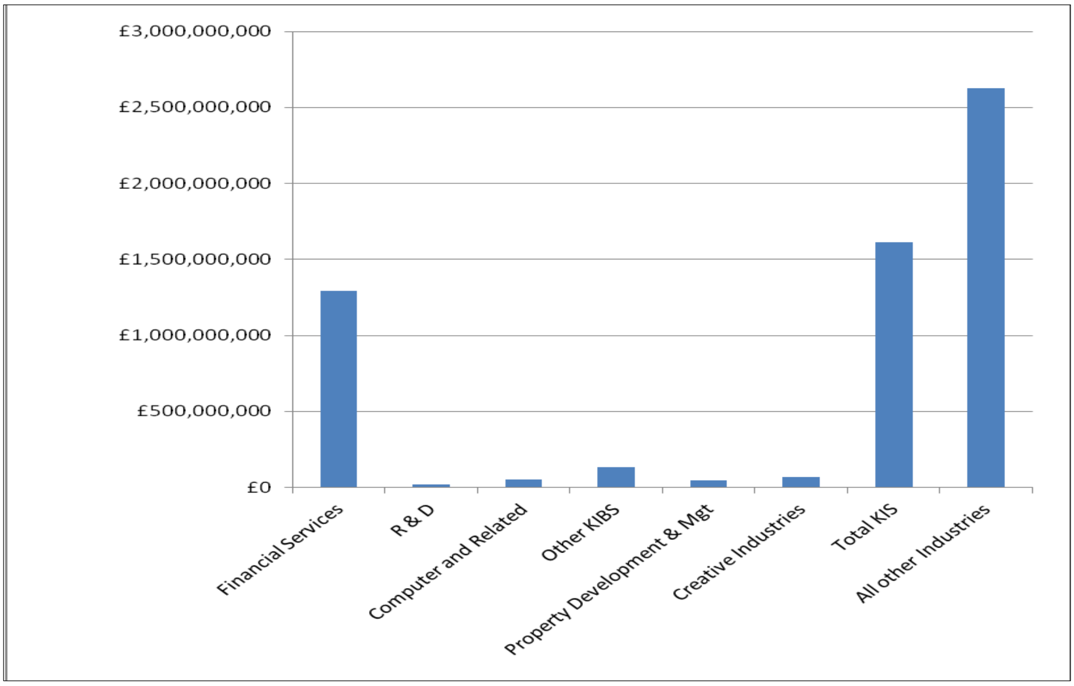
Figure 3.28 shows absolute employment in KIBS in the "core cities" and their surrounding regions in 2008. It is evident that although some de-industrialised regions such as Yorkshire and Humber (including cities Sheffield and Leeds) show signs of industrial restructuring processes towards knowledge intensive services economy, the North East and its core city Newcastle shows little of this trend. Knowledge intensive business services and creative industries in the city region have shown considerable growth potential although total employment remains low in comparison to other core city regions. The Newcastle economy is much less dominated by KIBS but nevertheless shows significant increases in the employment in the R&D sector.

3.3.7 Sectoral analysis

Over the past twenty years the expansion of the British economy, particularly in the South East has been supported by growth in the financial services industry. With the most recent financial crisis it is unlikely that this sector can sustain growth as observed during the previous decade. ONS figures show that UK has lost 102,000 jobs in Finance and Business Services from December 2008 to March 2009 alone. Redundancies in the same sector amounted to 52,000 for the period October-December 2008 and there were 68,000 vacancies less in the sector compared to the previous year. Although the threat to financial services is nation-wide, the industry is now more concentrated in central London. However, other cities and towns such as Bristol, Liverpool, some smaller towns in the Greater South East which have developed concentration of financial sector may suffer as well. Other, non financial KIBS may loose out as well. This is because business services may suffer job loses as a result of a decrease in demand from the financial sector. These effects however should not be overstated at least for London as London still remains an important world financial centre.

The significance of the Financial sector in the UK in terms of turnover is evident from Figure 3.29. It represents 31% of the total UK turnover and Finance and KIBS together make up 38% of the total UK turnover.

Figure 3.29 KIBS Turnover (2008)

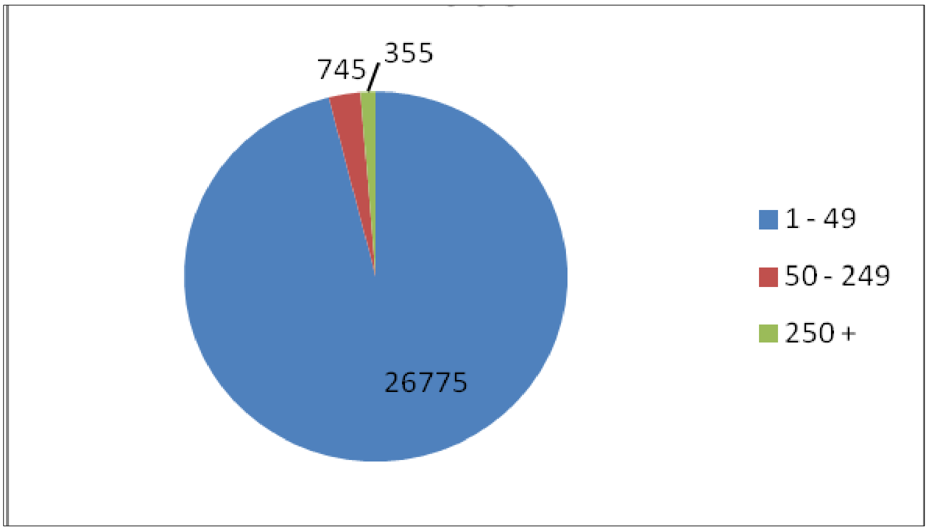


Source: IDBR, ONS

3.3.8 Size and turnover

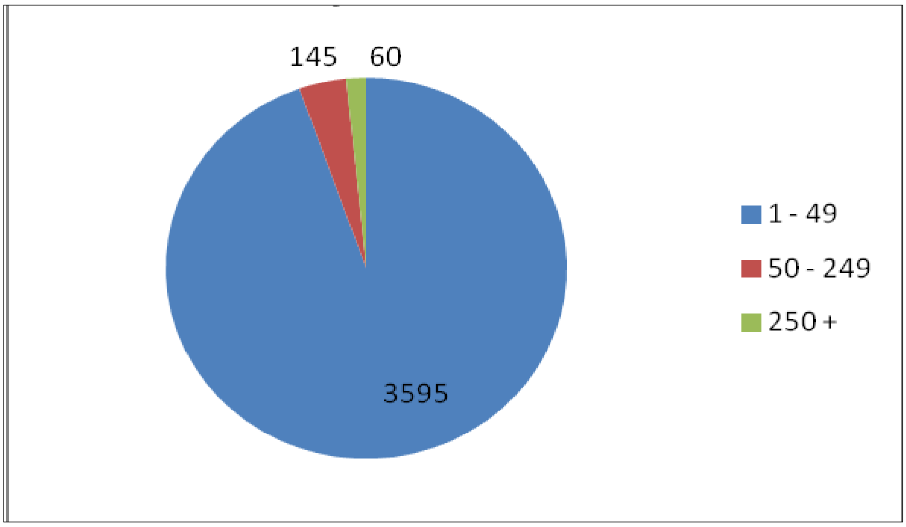
In terms of size, the majority of KIBS companies are small (Figures 3.30 to 3.33) with only Finnacial Services and R&D showing some proportion of large companies (Figures 2.30 and 2.31)[1].

Figure 3.30 Financial Services number of companies (2008)



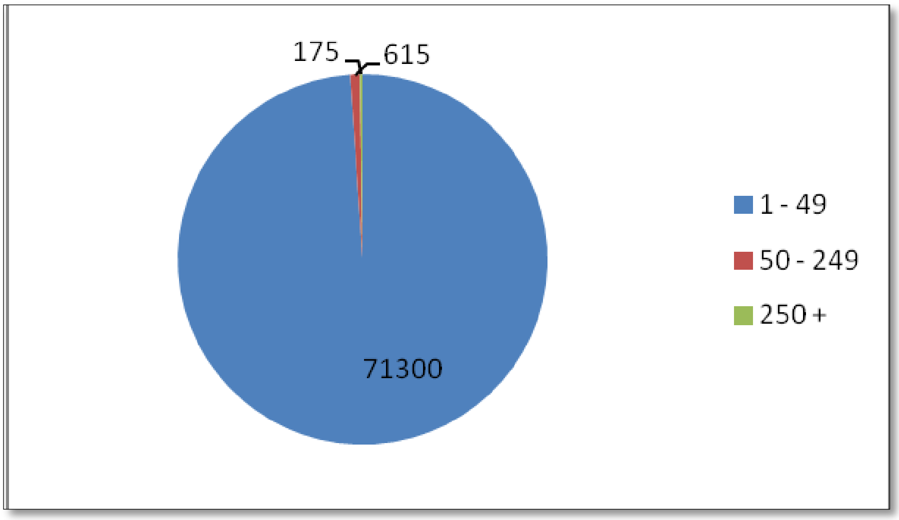
Source: IDBR, ONS

Figure 3.31 R&D Number of companies (2008)



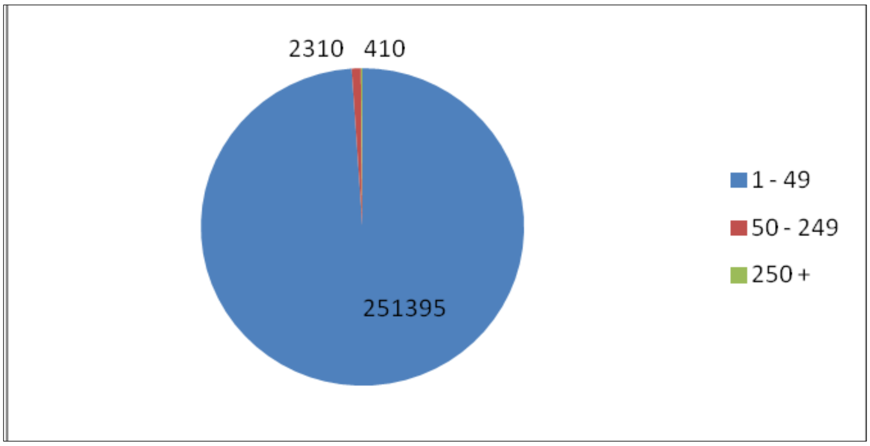
Source: IDBR, ONS

Figure 3.32 Creative industries number of companies (2008)



Source: IDBR, ONS

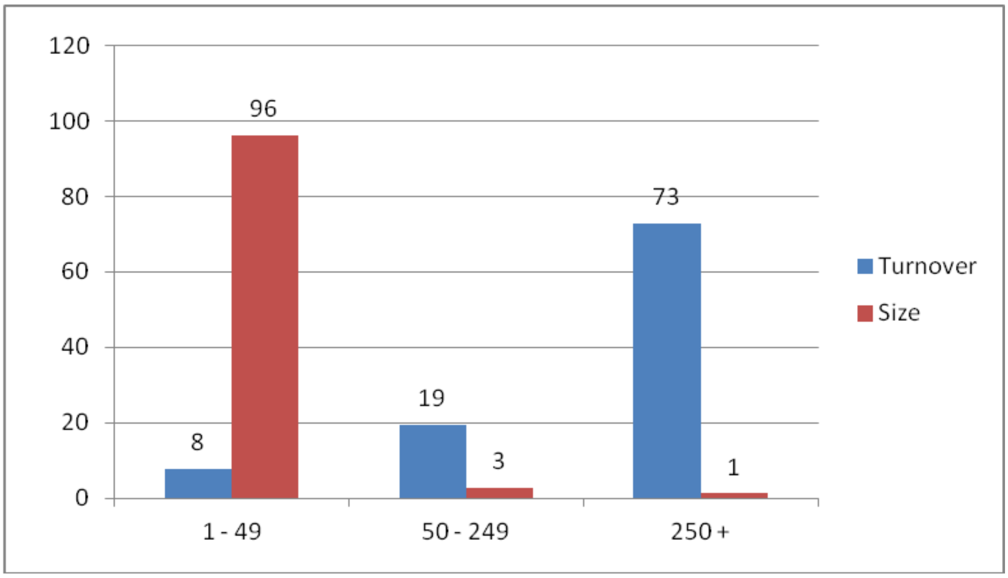
Figure 3.33 Other KIBS number of companies



Source: IDBR, ONS

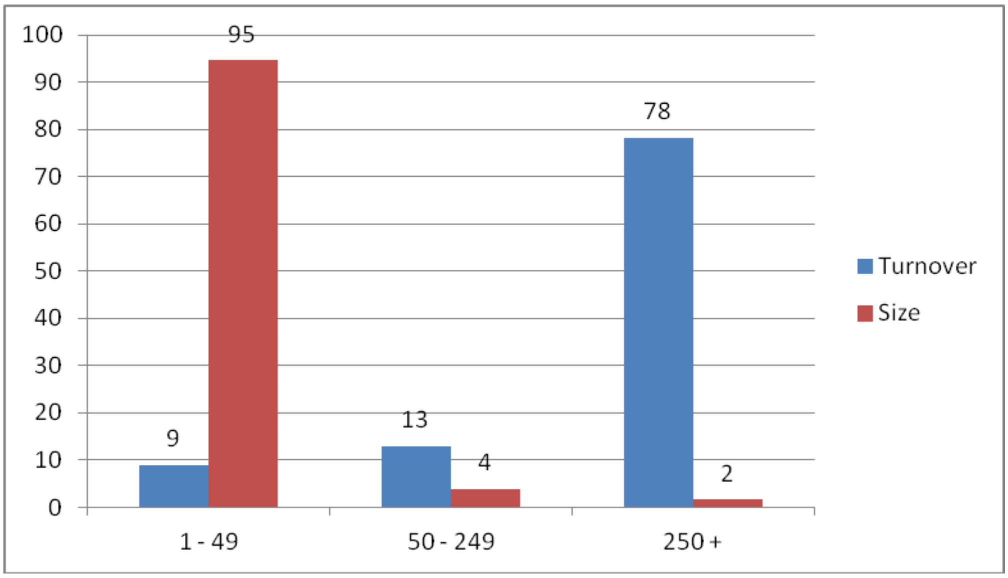
Although majority of KIBS are small, much of the sector's employment and production output is generated by large KIBS businesses, within firms of more than 250 employees (Figure 3.34). In the financial sector 73% of turnover is generated by only 1% of large (more than 250 employees) companies (there are only 355 large finance companies in the UK in 2008). Similar picture emerges for R&D with 78% of turnover generated by 2% of large enterprises (Figure 3.35). Property Development and Management sub-sector shows the opposite trend wherby almost 100 per cent of small companies generate 81% of turnover (Figure 3.36). The distribution of turnover between small, medium and large companies in other sub-sectors is more even (Figures 3.37, 3.38 and 3.39).

Figure 3.34 Financial Industries size and turnover as a percentage of total turnover



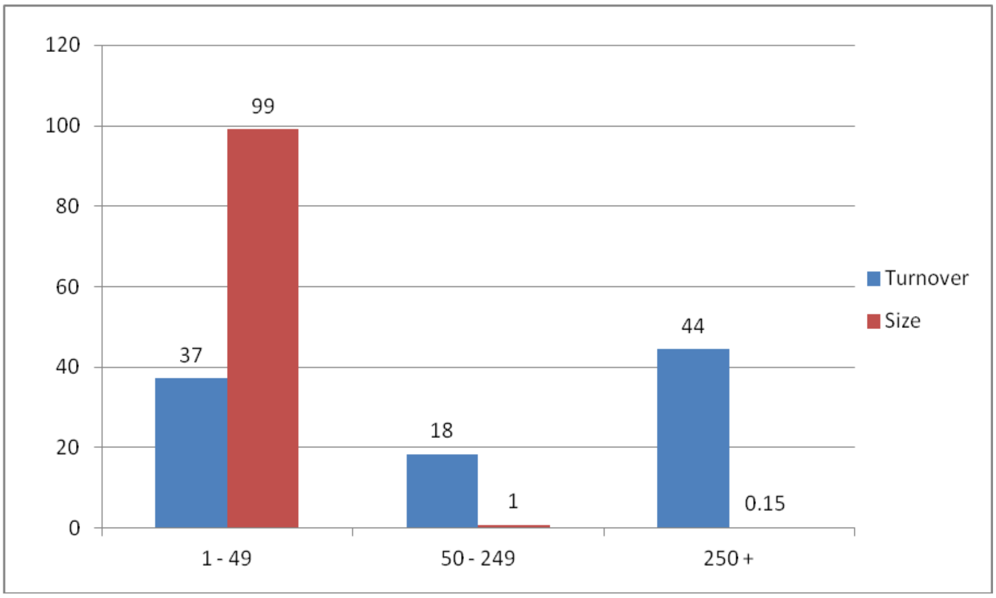
Source: IDBR, ONS

Figure 3.35 R&D size and turnover as a percentage of total turnover



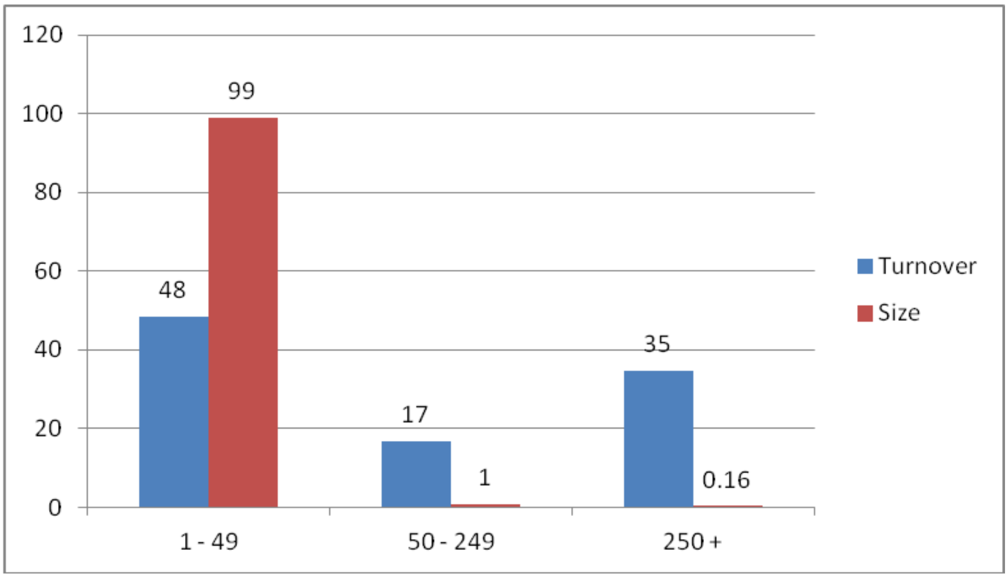
Source, IDBR, ONS

Figure 3.36 Software size and turnover as a percentage of total turnover



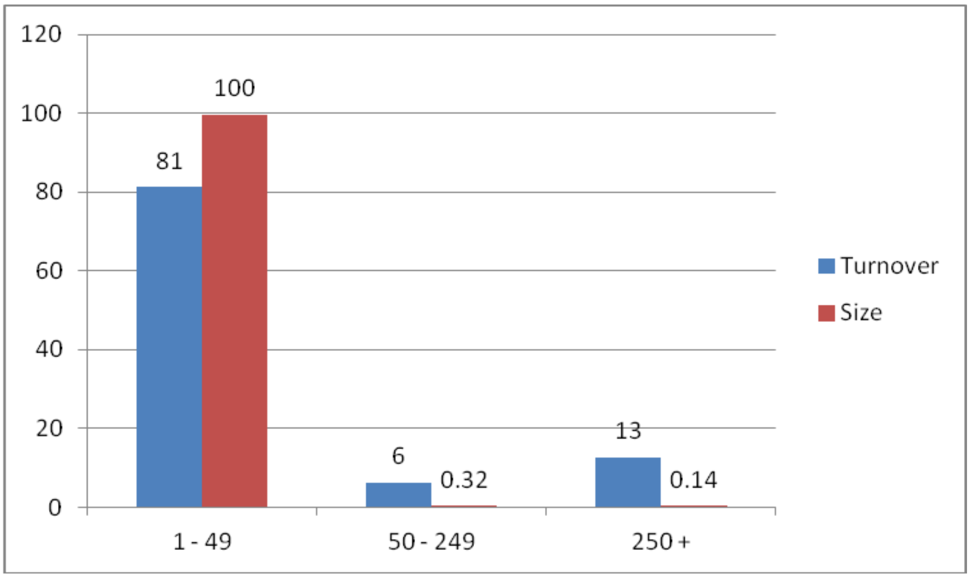
Source: IDBR, ONS

Figure 3.37 Other KIBS size and turnover as a percentage of total turnover



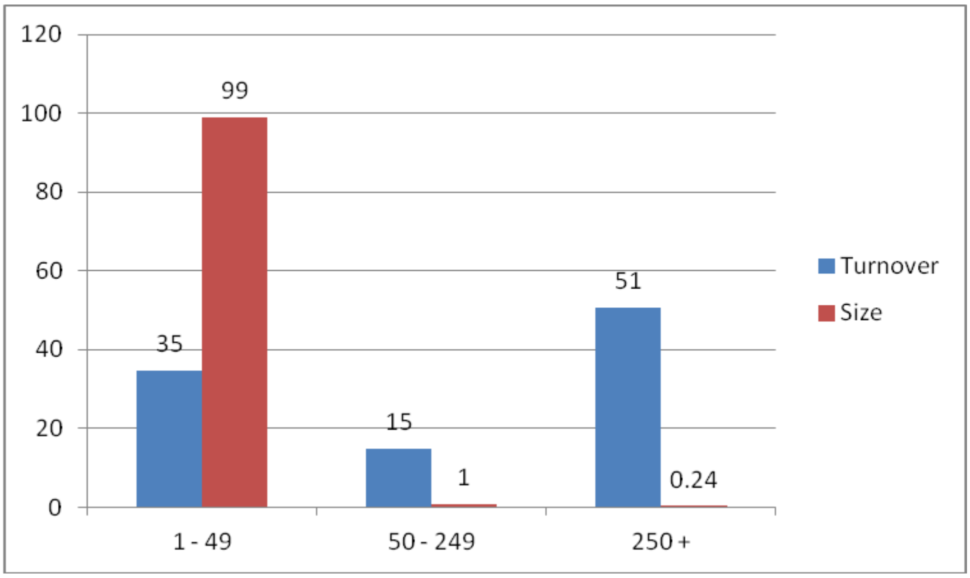
Source: IDBR, ONS

Figure 3.38 Property Development and Management size and turnover as a percentage of total turnover



Source: IDBR, ONS

Figure 3.39 Creative Industries size and turnover as a percentage of total turnover



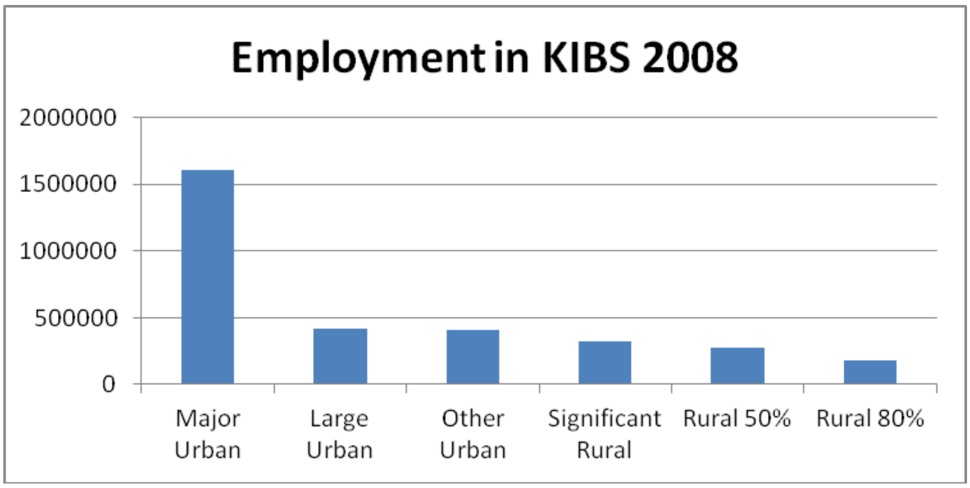
Source: IDBR, ONS

3.3.9 Rural/Urban analysis

It has been emphasised in the KIBS literature that the sector gravitates towards large cities. Figures 3.40 and 3.41 indeed show that KIBS are predominantly concentrated in urban areas with London leading the way. However, Figure 3.42 shows that the highest growth of employment in KIBS from 2000 to 2008 was in Lager urban followed by Rural50 and Rural80 areas respectively. In terms of KIBS entrepreneurship growth, remarkably, the growth in numbers of KIBS enterprises is highest in most significantly rural areas- Rural80, followed by Rural50 and is smallest in most significantly urban areas-Major Urban and Large Urban. KIBS growth outside large cities has been an outcome of the population shifts, technological, infrastructural changes and improvements in transport and telecommunications.

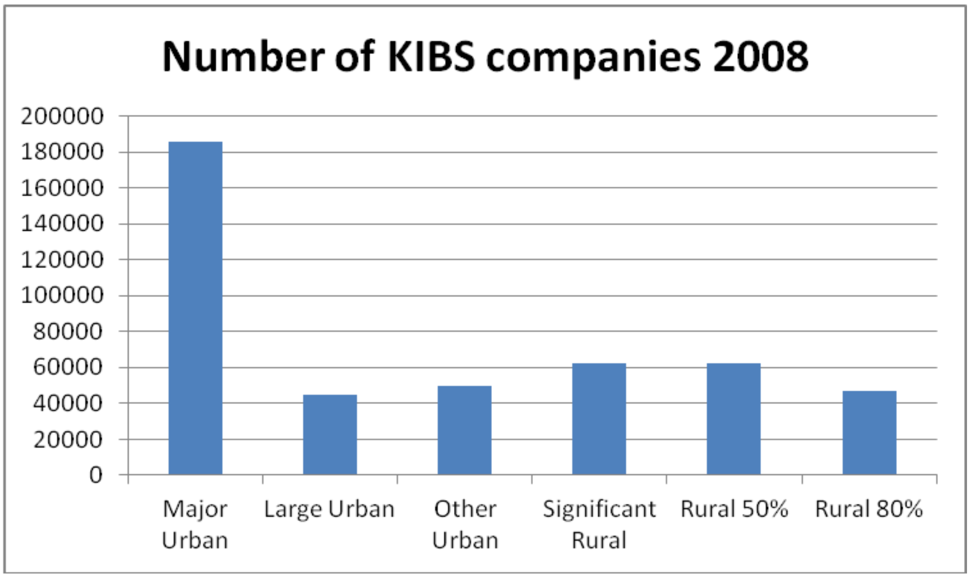
It is, however, believed that rural/peripheral KIBS serve narrow local markets and that the expansion and specialization of service functions is low outside the major cities. For example, O'Farrell and Hitchens (1990) show that producer service firms in peripheral areas have a narrower client base, a less qualified and skilled workforce and less wide-ranging experience. Keeble et al (1992) found that it was firms (manufacturing and service) in accessible rather than remote rural areas that had significantly higher ratings on a series of indicators measuring innovation, new products and technological expertise.

Figure 3.40 Employment in KIBS by the type of region (2008)



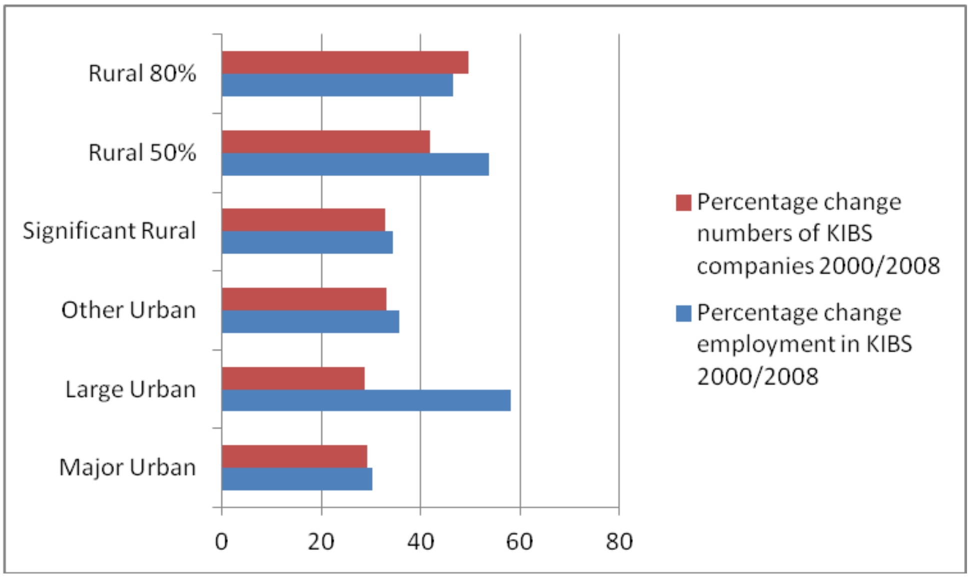
Source, IDBR, ONS

Figure 3.41 Number of KIBS companies by the type of region (2008)



Source, IDBR, ONS

Figure 3.42 Percentage change in KIBS employment and numbers of KIBS by the type of region (2000/2008)



Source:IDBR, ONS

3.3.10 Conclusion

Perhaps the most important but also recurring aspect of the UK KIBS location pattern is the geographic concentration of most types of KIBS in London and the South East. KIBS are located in metropolitan areas such as London from where they serve local, national as well as international markets. London exhibits supremacy over all other areas with 34% of employment in KIBS over the national total. However, London shows a slight retraction in KIBS employment from 2000-2008 but from a very high relative base compared to other areas. It should be noted that this retraction in KIBS employment in London is led by loss of jobs in the financial sectors (30%) whereas there has been a growth in employment in all other KIBS in London. Other English metropolitan counties with relatively high concentration of KIBS are: Greater Manchester, West Midlands (includes Birmingham) and West Yorkshire (includes Leeds). Highest percentage change of growth of KIBS employment from 2000-2008 was noted in Sheffield and Bristol. These two cities, including London and Liverpool, exhibit the highest importance of KIBS sectors relative to all other sectors.

KIBS are believed to benefit from agglomeration economies and presence of local demand and international connectedness in large cities. However, apart from London, amongst the English core cities only Manchester exhibits high concentration of KIBS. Moreover, only Manchester compares favourably in terms of concentration of KIBS to other leading non- city areas namely Surrey, Hertfordshire and Hampshire counties. This means that apart from London and Manchester, other core cities still lag behind in terms of their concentration of KIBS. KIBS are predominantly located within more economically advanced areas of the Greater South East in relative close proximity to London.

KIBS seem to be attracted by good transport connectivity, availability of local amenities and good quality of life. This implies that accessibility to clients matter for KIBS since from these well connected locations they can reach wider customer base. Indeed, data further shows KIBS growth in rural areas which indicates that rural KIBS may be serving distant customers over and above their locations. However, it cannot be concluded from the descriptive analysis whether the underlying cause of KIBS growth in rural places may also be related to growth in local demand for KIBS.

Employment patterns show that de-industrialised (mining and textile) region of Yorkshire and Humber shows some signs of transformation into knowledge intensive service economy given its high concentration of financial employment in Leeds and growing professional KIBS sector ("Other KIBS") in Sheffield. Another de-industrialised region-the North East including Newcastle shows less of this trend. However, Newcastle employment data shows increasing importance of R&D. The West Midlands also shows increase in employment in computer and related sector, other KIBS and property development and management.

From the sectorial perspective the highest growth between 2000 and 2008 was noted in the Property Development and Management sector with Financial Services growth comparatively low. However, the financial Industry in the UK shows a remarkable 31% share of the total UK economy turnover. This sector is very important for the UK economy and will continue to be so in the near future.

What are the principal factors underlying the empirically observed concentration of KIBS in the urban hierarchy in the UK? The answer seems to lie in the economies of agglomeration or more precisely economies of urbanisation. First, it is a pool of skilled human resources. There is general agreement in the literature that human resources constitute the major factor influencing KIBS location (Coffey and Shearmur, 1997). This is because many KIBS require a highly qualified labour force which tends to be concentrated in major metropolitan areas.

A second factor comprises of opportunities related to forward linkages and demand. It has been shown that head offices of large manufacturing and service firms are located in metropolitan areas. In cases where KIBS services are being purchased it is not by production units themselves (which may be located further away from core metropolitan regions) but by the head offices. However, IDBR data shows a degree of decentralisation of KIBS into non-metropolitan counties (mostly located close to London) such as Surrey. It follows that opportunities induced by the availability of good transport connections and IT and telecommunications allow KIBS to locate a bit further from the immediate source of demand. This is consistent with Keeble and Nachum (2002) who note de-centralisation of KIBS to the amenities rich, rural areas in the south of England.

However, prospects for development aided by KIBS in de-industrialised regions are also relatively encouraging even though the positive percentage changes in KIBS employment is such regions should be interpreted with caution given the initial low base numbers. However, KIBS in non-metropolitan regions such as those located in de-industrialised regions may well be regionally important not because of their global competitiveness (most such KIBS are indeed more locally orientated compared to their metropolitan counterparts) and global reach but because of important functions and support they provide to local non-KIBS sectors.

APPENDIX IV: KIBS QUESTIONNAIRE

Improving the Competitiveness of Knowledge Intensive Business Service SMEs in the North East/West Midlands

Please note that we require this questionnaire to be completed by the person who is in day-to-day charge of the business. All the information you supply us with will remain confidential and will only be used in an aggregated form along with information supplied to us by other companies.

For some questions we ask you to consider the region in which you are located, the sourcing of knowledge, and the competitiveness of your company. In each case please apply the following definitions:

- Region – this is the location of your office/plant and in this instance will relate to North East England.

- Knowledge - defined as broadly consisting of research and development, ideas, skills, expertise, and other information that is, or potentially can be, used to make the operation of your company more effective.

- Competitiveness – relates to the ability of your company to maintain or improve its financial position through maintaining or improving the market share for its products and/or services.

Please complete the following:

Name of respondent	
Telephone Number	
Name of company	

1. What is your role in this business?

Owner ☐
Manager ☐
Other, please specify below ☐

……………………………………………….

2. In what year was the business established?

………………………………………………………………………………………

3. The main activity of the business is? *Please enter SIC code provided.*

………………………………………………………………………………………

4. What is the current number of employees?

Number…………………………………………………….

5. Would you describe your main geographic business location as being...

Please tick one box

1. In a city ☐
2. In a town ☐
3. In a village ☐
4. In open countryside ☐

6. How did you choose your main business location? Please rate each of the following attributes of your geographic location (your city, town or village). Please rank each on a scale of 1 to 10 where 1 is not important at all and 10 is extremely important.

Proximity to customers	1	2	3	4	5	6	7	8	9	10
Proximity to suppliers	1	2	3	4	5	6	7	8	9	10
Availability of local professional/skilled staff	1	2	3	4	5	6	7	8	9	10
Proximity to other firms in your industry	1	2	3	4	5	6	7	8	9	10
Availability of local informal networks	1	2	3	4	5	6	7	8	9	10
Availability of local business networks	1	2	3	4	5	6	7	8	9	10
Good international connectivity	1	2	3	4	5	6	7	8	9	10
Low cost of support staff/premises/business rates	1	2	3	4	5	6	7	8	9	10
Proximity to owner's/manager's home	1	2	3	4	5	6	7	8	9	10
Good quality of life	1	2	3	4	5	6	7	8	9	10
Other, please specify …………………………..	1	2	3	4	5	6	7	8	9	10

7. **Who are your main customers (please chose from the list below)?**

………..

8. **Who are your main customers/clients and what is their estimated share in sales (%, total=100)?**

--------- UK manufacturing companies

----------Regional manufacturing companies

----------UK service companies

----------Regional service companies

----------Foreign manufacturing companies

----------Foreign service companies

----------UK consumers

----------Regional consumers

----------Foreign consumers

----------UK scientific research organizations (universities, institutes, etc.)

----------Foreign scientific research organizations (universities, institutes, etc.)

----------Domestic public procurements (not included in domestic scientific research organizations)

---------Others (please, specify)

....

9. Do you have income from licencing, royalties or other form of intellectual assets? Yes/No

....

10. If so, what is your average share of income from such assets in your total revenues? In %_

11. Please give approximate figures for the following

	2006	2009
Turnover (in £)		
%Share of exports in sales		
Employees		
R&D to sales ratio		

12. Please indicate the annual profits of the business by ticking one of the ranges below

a. Less than or equal to 0% of turnover (i.e. a loss or break even) ☐
b. Above 0% and up to 1% of turnover ☐
c. Above 1% and up to 5% of turnover ☐
d. Above 5% and up to 10% of turnover ☐
e. Above 10% of turnover ☐

If over 10% please specify the percentage ……………………………..

13. Has your business introduced any new or significantly improved products or services in the last three years?

Yes No

If yes, please give details and state how many

…………………………………………………………………….

14. Has your business introduced any new or significantly improved internal organisational processes in the last three years? (e.g. introducing a new work routine, improving IT systems, business co-operation, new managerial or HR practices etc.)

Yes No

If yes, please give details and state how many

……………………………………………………………………

15. Please estimate share of your turnover in 2009 which has been realized from:

New or significantly improved products (goods or services) introduced in the last three years in % ……

16. Has your business expanded into new markets (including non-local geographical markets) or introduced new marketing methods in the past three years?

Yes No

If yes, please give details

…………………………………………………………………………

17. Did your business work with any external organisations or partners in introducing any of these innovations (e.g. another

business, university staff, innovation centre, business network etc.)?

Yes No

If yes, please give details

…………………………………………………………………..

18. On a 1 - 10 scale (where 0 is never and 10 is very often) how often does your company utilise the following sources to obtain outside knowledge?

	Within your region	Elsewhere in the UK	Overseas
Customers			
Suppliers			
Rival firms			
Employment			
Licences			
Consultants			
Formal strategic alliances/joint ventures			
Public sector organisations			
Private sector organisations, such as private training or research providers, and consultants			
Literature/patents			
Conferences, trade fairs, exhibitions			
Professional and trade associations			
Universities or other higher education institutes			
Contract research			
Research cooperation			
Business networks			
Informal contacts			
Other (please state)			

19. Please name any business networks that your business uses to obtain knowledge or advice?

……………………………………………………………………

20. What types of knowledge does your company most frequently access from its external sources? Please rank your answer on a scale of 1 to 10 where 1 is never obtained, and 10 is very often obtained.

Knowledge Type	**Please indicate on a scale of 1 (never obtained) to 10 (very often obtained)**									
New technology	1	2	3	4	5	6	7	8	9	10
New product development	1	2	3	4	5	6	7	8	9	10
New service development	1	2	3	4	5	6	7	8	9	10
IT development/support	1	2	3	4	5	6	7	8	9	10
Finance, accounting and auditing, legal expertise	1	2	3	4	5	6	7	8	9	10
Access to management expertise, marketing expertise, or training, HR or Recruitment	1	2	3	4	5	6	7	8	9	10
Access to market or competitor intelligence	1	2	3	4	5	6	7	8	9	10
Access to new creative ideas	1	2	3	4	5	6	7	8	9	10

21. To what extent is the internal resource base (skills, R&D/innovation, IT and physical infrastructure, etc.) of your company sufficient to effectively utilise and implement the knowledge it sources externally? Please indicate on a scale of 1 (not sufficient) to 10 (extremely sufficient)

…………………………………………………

22. Please rate the following sources of internal expertise for your company competitiveness (where 1 is not important and 10 is extremely important)

a) research and technical development knowledge________________
b) practical engineering knowledge_____________________________
c) software (programming) knowledge __________________________
d) sales and marketing knowledge _____________________________
e) financial and accounting knowledge__________________________
f) managerial knowledge___________________________________
g) creative ideas/knowledge_________________________________
h) other ideas/knowledge (please specify) _____________________

23. On a 1 - 10 scale, please rate the significance of the following barriers (where 1 is not a barrier and 10 is a very significant barrier) your company faces in maintaining or improving competitiveness: Please indicate the importance of each factor.

Barrier	Importance									
Long distance to main markets	1	2	3	4	5	6	7	8	9	10
Problems recruiting skilled workforce locally	1	2	3	4	5	6	7	8	9	10
Unable to access markets outside the region	1	2	3	4	5	6	7	8	9	10
Increased competition faced from companies which are located outside the region	1	2	3	4	5	6	7	8	9	10
Limited opportunities for networking and exchange of information in your geographic location(city/town/village)	1	2	3	4	5	6	7	8	9	10
Insufficient quality of knowledge held by others in your region	1	2	3	4	5	6	7	8	9	10
The cost of sourcing knowledge from external sources	1	2	3	4	5	6	7	8	9	10
Other (please state) …………………………………………………….	1	2	3	4	5	6	7	8	9	10

24. Do you have difficulties to recruit highly skilled workforce within the region? Please, evaluate in range from 1-10 whereby 1=extreme difficulties, 10 = no difficulties

…………………………………………………………………….

25. Please rank the difficulty in acquiring each of the following sets of highly skilled using a scale of 1-10, with 1 =very difficult, 10 =very easy (i.e., there seems to be a surplus of these skills on the labour market):

a. research and technical development skills _______________
b. practical engineering skills ____________________________
c. software (programming) skills __________________________
d. sales and marketing skills _____________________________
e. financial and accounting skills __________________________
f. managerial skills______________________________________
g. creative skills____
h. other skills (please specify)_____________________________

Are you are interested in participating in the interview with the researcher?

...

APPENDIX V: REGRESSION ANALYSIS: THE DETERMINANTS OF KIBS INNOVATION

Table V.I Product or Service Innovation

	B	S.E.	Wald	Sig.	Exp(B)
Firm Size	.004	.007	.363	.547	1.004
Firm vintage	.002	.008	.079	.779	1.002
City vs rest	.510	.409	1.556	.212	1.665
Region	-.532	.372	2.046	.153	.588
T and P KIBS	.423	.363	1.353	.245	1.526
R&D>10%	**2.486**	**.764**	**10.596**	**.001**	**12.008**
R&D 6%-10%	**3.621**	**.993**	**13.294**	**.000**	**37.358**
R&D 1%-5%	1.552	.862	3.244	.072	4.721
Various international formal knowledge sources	-.252	.302	.696	.404	.777
National Public and Professional Knowledge Infrastructure	.009	.199	.002	.964	1.009
Regional and National Commercial Networks	.287	.186	2.375	.123	1.333
International Customer and Informal Networks	**.684**	**.252**	**7.377**	**.007**	**1.982**
Regional Informal Networks	**.711**	**.220**	**10.448**	**.001**	**2.037**
Regional and National Research Cooperation	-.079	.211	.139	.709	.924
Regional Public Knowledge Infrastructure	.114	.212	.288	.592	1.121
Regional and National Patents and Literature	-.066	.196	.114	.736	.936
Regional and National Customers	-.023	.182	.016	.901	.978
Regional and National Employees	-.106	.179	.353	.553	.899
Regional and National Rivals	.098	.212	.215	.643	1.103
Regional and National Suppliers	.096	.198	.236	.627	1.101
Regional and National Licences	**.486**	**.190**	**6.550**	**.010**	**1.626**
Long distance to main markets	-.042	.112	.143	.706	.958
Problems recruiting skilled workforce locally	.097	.083	1.351	.245	1.102
Unable to access markets outside the region	-.061	.132	.210	.647	.941
Increased competition faced from companies which are located outside the region	.044	.087	.261	.609	1.045
Limited opportunities for networking in your city/town/village	-.272	.150	3.282	.070	.762
Insufficient quality of knowledge held by others in your region	.035	.132	.072	.789	1.036
The cost of sourcing knowledge from external sources	-.145	.094	2.384	.123	.865
Constant	-.198	.473	.175	.675	.820
X2 model	79.818, df=28, p=0.000				
Nagelkerke pseudo R2	0.409				
N	221				
Note P<0.05 variables highlighted in bold					

Table V.II Process Innovation

	B	S.E.	Wald	Sig.	Exp(B)
Firm Size	**.032**	**.010**	**10.885**	**.001**	**1.032**
Firm vintage	.002	.008	.078	.779	1.002
City vs rest	.173	.404	.184	.668	1.189
Region	-.034	.363	.009	.926	.967
T and P KIBS	-.529	.367	2.077	.150	.589
R&D>10%	-.149	.705	.045	.832	.861
R&D 6%-10%	.109	.708	.024	.878	1.115
R&D 1%-5%	-1.105	.974	1.288	.256	.331
Various international formal knowledge sources	-.111	.150	.548	.459	.895
National Public and Professional Knowledge Infrastructure	.039	.196	.039	.844	1.039
Regional and National Commercial Networks	.137	.172	.632	.427	1.147
International Customer and Informal Networks	-.369	.248	2.213	.137	.691
Regional Informal Networks	**.858**	**.214**	**16.065**	**.000**	**2.359**
Regional and National Research Cooperation	.049	.171	.081	.776	1.050
Regional Public Knowledge Infrastructure	**-.457**	**.221**	**4.275**	**.039**	**.633**
Regional and National Patents and Literature	.107	.175	.377	.539	1.113
Regional and National Customers	.232	.172	1.816	.178	1.261
Regional and National Employees	-.054	.168	.102	.750	.948
Regional and National Rivals	.067	.177	.142	.706	1.069
Regional and National Suppliers	-.214	.196	1.198	.274	.807
Regional and National Licences	.104	.169	.379	.538	1.109
Long distance to main markets	-.003	.098	.001	.977	.997
Problems recruiting skilled workforce locally	.054	.081	.436	.509	1.055
Unable to access markets outside the region	-.130	.124	1.109	.292	.878
Increased competition faced from companies which are located outside the region	-.151	.094	2.585	.108	.860
Limited opportunities for networking in your city/town/village	.001	.115	.000	.992	1.001
Insufficient quality of knowledge held by others in your region	-.024	.117	.042	.837	.976
The cost of sourcing knowledge from external sources	.049	.082	.360	.549	1.051
Constant	-.570	.446	1.631	.202	.565
X2 model	47.489, df=28, p=0.012				
Nagelkerke pseudo R2	0.272				
N	219				
Note P<0.05 variables highlighted in bold					

Table V.III Marketing Innovation

	B	S.E.	Wald	Sig.	Exp(B)
Firm Size	.009	.007	1.761	.184	1.009
Firm vintage	-.005	.009	.312	.577	.995
City vs rest	.427	.380	1.264	.261	1.533
Region	.002	.334	.000	.994	1.002
T and P KIBS	.136	.338	.162	.688	1.146
R&D>10%	-.981	.726	1.828	.176	.375
R&D 6%-10%	-1.066	.759	1.974	.160	.344
R&D 1%-5%	.573	.766	.560	.454	1.774
Various international formal knowledge sources	-.089	.199	.201	.654	.915
National Public and Professional Knowledge Infrastructure	-.028	.172	.027	.871	.972
Regional and National Commercial Networks	**.296**	**.168**	**3.119**	**.077**	**1.345**
International Customer and Informal Networks	**.282**	**.169**	**2.787**	**.095**	**1.326**
Regional Informal Networks	.203	.182	1.237	.266	1.225
Regional and National Research Cooperation	.181	.170	1.130	.288	1.199
Regional Public Knowledge Infrastructure	-.113	.186	.374	.541	.893
Regional and National Patents and Literature	.024	.164	.022	.883	1.024
Regional and National Customers	-.098	.156	.394	.530	.907
Regional and National Employees	.013	.161	.007	.935	1.013
Regional and National Rivals	-.049	.171	.084	.772	.952
Regional and National Suppliers	.264	.179	2.171	.141	1.303
Regional and National Licences	.066	.159	.170	.680	1.068
Long distance to main markets	-.030	.091	.107	.744	.971
Problems recruiting skilled workforce locally	-.020	.078	.064	.800	.981
Unable to access markets outside the region	.070	.111	.393	.531	1.072
Increased competition faced from companies which are located outside the region	**.129**	**.077**	**2.781**	**.095**	**1.137**
Limited opportunities for networking in your city/town/village	-.184	.120	2.360	.125	.832
Insufficient quality of knowledge held by others in your region	.155	.114	1.841	.175	1.168
The cost of sourcing knowledge from external sources	-.032	.077	.173	.677	.968
Constant	-.958	.420	5.208	.022	.383
X2 model	31.421, df=28, p=0.299				
Nagelkerke pseudo R2	0.184				
N	220				
Note P<0.10 variables highlighted in bold					

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